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Magnificent Meatball Maker

A Reading A-Z Level U Benchmark Book

Word Count: 1,093

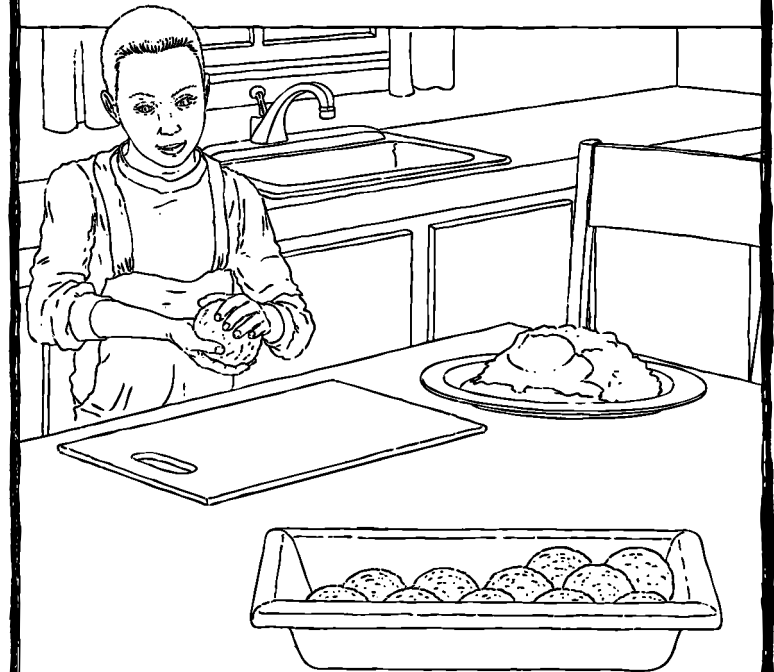



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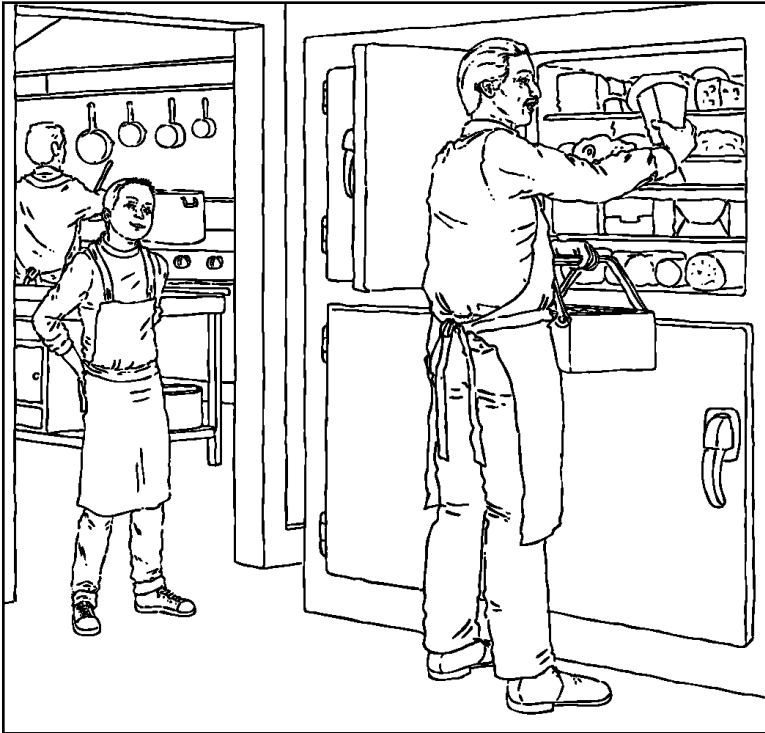
Magnificent Meatball Maker



Written by Alyse Sweeney
Illustrated by Tom Barrett

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Level U Benchmark Book
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Correlation

LEVEL U

Fountas & Pinnell	Q
Reading Recovery	24
DRA	40



Timmy checked his list to see what he still needed to **prep**. He had already peeled and minced 15 heads of garlic, cleaned and chopped 10 bunches of basil, and peeled 20 potatoes. All that was left to do was dice the roasted red peppers and make the rosemary marinade. Since Timmy's parents had divorced, he'd hung out at his Uncle Mario's Italian restaurant after school while his dad was still at work. But now Timmy prepped on Saturday afternoons like a real member of the kitchen staff.

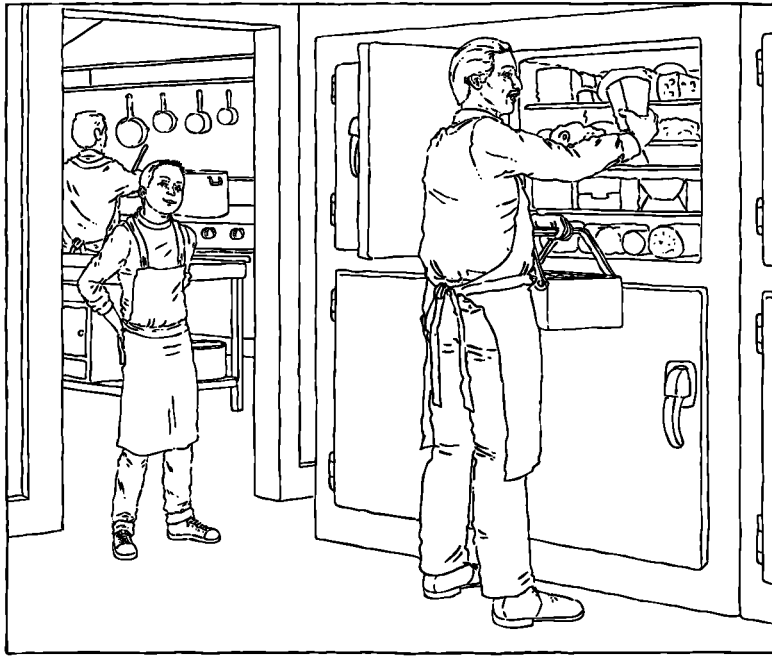
Mario's Kitchen was a casual neighborhood restaurant just eight houses away from Timmy's dad's house. But people came from far and wide to feast on Chef Mario's food—like ants swarming a picnic. The celebrity status that chefs such as his uncle enjoyed is something Timmy **coveted**. He wanted to cause his own neighborhood sensation and take the **culinary** world by storm.

Timmy washed his hands and dried them on his apron before heading to the empty dining room for a soda break. He passed photos on the wall of famous people posing with his uncle. Actors, athletes, politicians, singers—even a president—ate at *Mario's Kitchen*. On the opposite wall hung glowing articles and raving reviews from some of the city's toughest **critics**. Timmy never tired of hanging out here, and who better to learn to cook from than his Uncle Mario—a self-trained and celebrated chef.

"Timmy, help me with these bags, eh?" huffed Uncle Mario, back from the Farmers Market, where he purchased the freshest **ingredients** daily, six blocks away. "Guess who just called me to make dinner **reservations** tonight? Wait, I'll give you some hints. He's as tall as a door, as fast as a cheetah, and . . . he's pitching Monday night for the Sluggers."

"Not Johnny McLane!" shrieked 10-year-old Timmy, following his uncle back to the kitchen.

"The one and only—and he requested *Mario's Magnificent Meatballs and Spaghetti*, so I've got to get cooking before my 4 o'clock flight to meet **investors** in Chicago."



Uncle Mario cruised to the walk-in and began snatching ingredients for his famous meatballs—beef, pork, veal, aged parmigiana cheese . . .

“So, Chef Timmy,” Uncle Mario asked while grinding the meat, “what delectable dishes did you cook at home this week?”

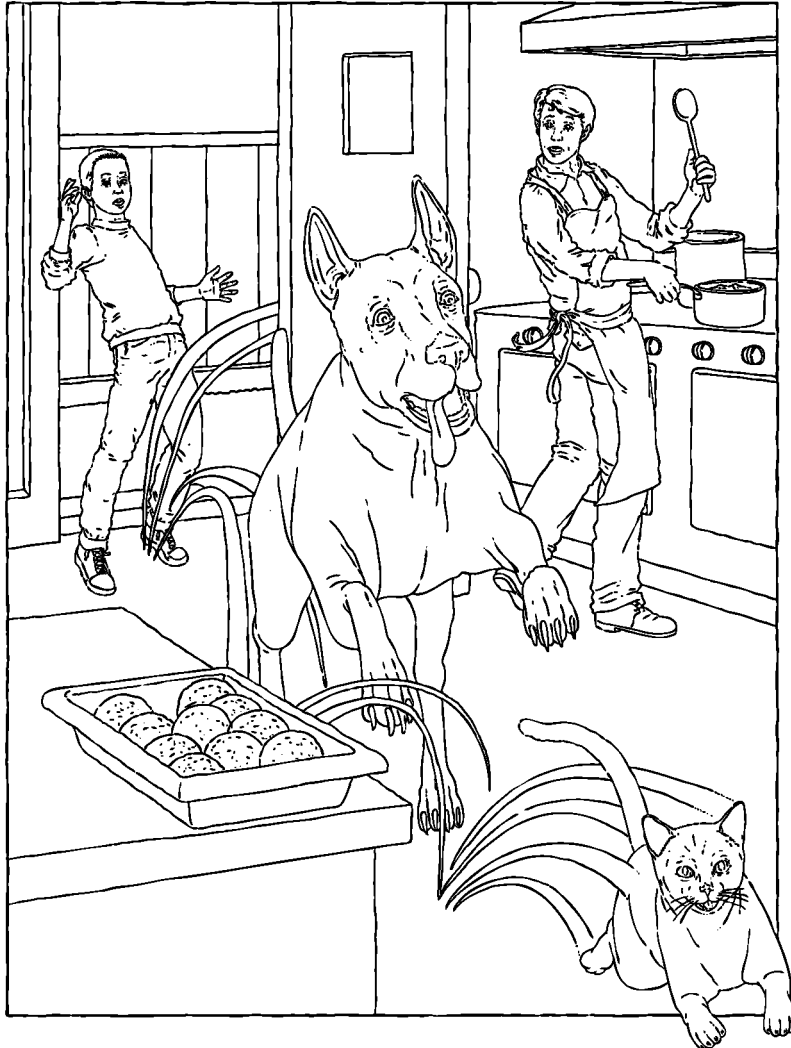
Timmy described Monday’s fettuccine alla carbonara and Wednesday’s chicken cutlets before asking why *Mario’s Magnificent Meatballs and Spaghetti*—his uncle’s **signature** dish—was taken off the menu. These days, his uncle made the dish only by request.

“Those meatballs got more press than Tiger Woods!” chuckled his uncle. “Remember the lines around the block and customers squabbling for a table! My calm, charming, 65-seat restaurant became disorderly . . . frenzied . . . chaotic . . . riotous . . . downright zoolike! People acted like caged animals fighting over the best bits of meat. But I’m whipping up a plan to add those meatballs back to the menu.”

Timmy returned to his prep list, briefly wondering what his signature dish would be when he opened his own **bistro**. He watched as Uncle Mario mixed the ground meat in a gigantic, aluminum bowl, then his uncle moved to a secluded corner counter where he added the other ingredients. Only Uncle Mario made the meatballs and only he knew the secret spices that made this dish so irresistible—and so famous. He protected the recipe like a diamond. That’s why Timmy was stunned when his uncle handed him the secret recipe after baking this latest batch.

“Kiddo, I was going to entrust you with this recipe when you got older,” whispered Uncle Mario, “but since you’re already a top-notch chef, I want you to have it now. Let’s keep it our secret—from one chef to another.” Then off he went on his trip to Chicago, leaving Timmy to fill his head with the **implications**.

Between owning the secret meatball recipe and his baseball hero coming to the restaurant, Timmy felt like a balloon about to burst! He finished his prep work at 5:40 and was heading out the door when he was nearly knocked over by a screeching cat, chased by an enormous, barking dog.



The cat darted under the dishwasher, but the dog lost interest in its foe after smelling the mouth-watering meatballs on the counter. The horse-like canine stood on its hind legs and devoured the meatballs like a famished shark.

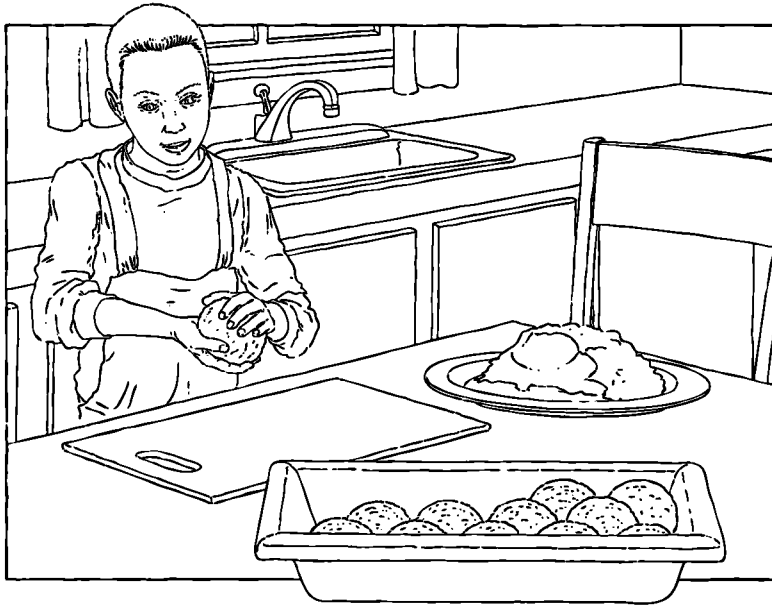
"Not Johnny McLane's dinner!" groaned the *sous chef*, who was in charge of the kitchen when Executive Chef Mario was away.

"What are we going to do?" said a weary cook.

While the cooks fretted, Timmy slipped into the chilly walk-in and retrieved the secret recipe from his jeans pocket. With urgency, he filled a plastic bin with the necessary ingredients, grabbed the grinder, and called over his shoulder, "I'll be back in an hour with Mario's meatballs." The looks of shock didn't register, and Timmy barely heard the riot of questions he left in his wake.

"Move over, Dad, I've got a meatball emergency here!" Timmy set out his ingredients as his dad pulled his smoked pea soup off the stove at home.

"Sounds serious," said his dad with a raised eyebrow. "Holler if you need me."

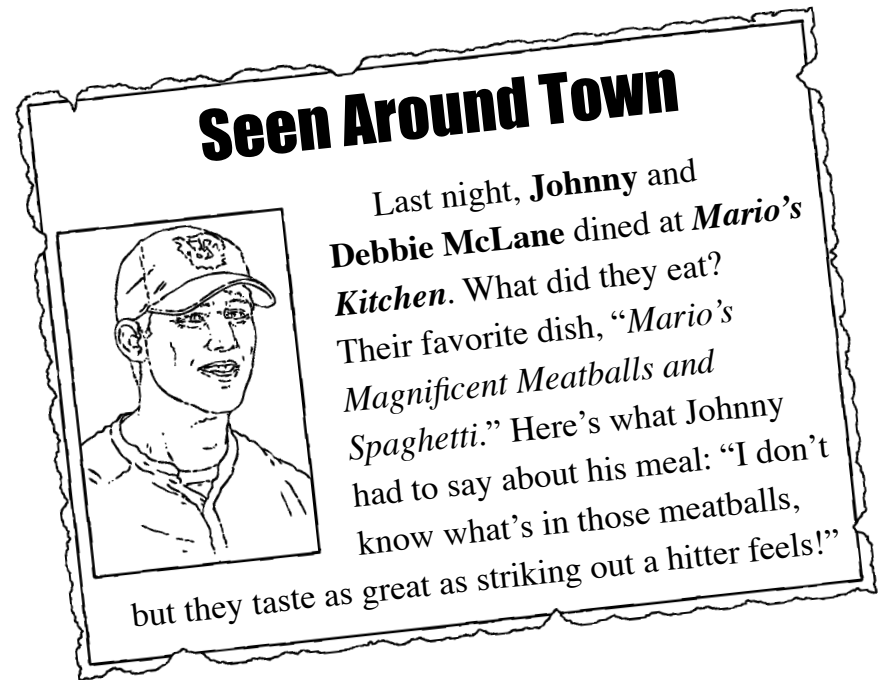


"So that's how he gets that flavor." Timmy smiled as he mixed, then rolled the ingredients into spheres nearly as big as baseballs for baking. Back at *Mario's Kitchen* under the watchful eyes of the sous chef, Timmy plopped the mystery-recipe meatballs into a huge pot of simmering tomato sauce for 20 minutes.

The cooks anxiously watched through the tiny, circular kitchen window as Johnny McLane and his wife ate their meatballs and spaghetti. The staff exchanged high-fives with Timmy when the couple "oohed" and "ahhed" over their first bites.

"Yesssss!" Timmy couldn't believe he just cooked for Johnny McLane—and his hero *liked* it!

Timmy forgot to ask for an autograph that night, but the quote in Sunday morning's paper was even better:



The ringing telephone brought Timmy back down to earth.

"Great news, kiddo. *Mario's Kitchen* is expanding from 65 seats to 115 seats, and *Mario's Magnificent Meatballs and Spaghetti* is going back on the menu! I'll show you the blueprints tomorrow, buddy."

A huge smile crept on Timmy's face, his future bright in front of him, as he wondered aloud, "Maybe I'll be promoted to Magnificent Meatball Maker!"

Baked Meatball Recipe

Uncle Mario's recipe is still a secret, but here's a baked meatball recipe you could try at home with the help of an adult.

Prep time: 20 minutes

Cook time: 20–25 minutes

Ingredients:

1/2 pound ground beef	1/4 cup frozen spinach, thawed and drained
1/2 pound ground pork	
1/2 pound ground lamb	1-1/2 teaspoons dried basil
1 large egg	1-1/2 teaspoons dried parsley
1/2 cup milk	
1/2 cup bread crumbs	1 teaspoon garlic powder
1/4 cup grated Parmesan cheese	1 teaspoon salt
1/4 cup diced onions	1/2 teaspoon pepper

- 1 Ask an adult to preheat the oven to 400 degrees Fahrenheit.
- 2 In a large mixing bowl, combine all the ingredients. Mix well using your hands.
- 3 Shape the meat mixture into about 20 round balls that are about 1 to 2 inches in diameter.
- 4 Place the meatballs onto a sheet pan lined with aluminum foil.
- 5 Ask an adult to place the pan in the oven. Bake the meatballs for about 20–25 minutes or until they are no longer pink in the center.

Enjoy with your favorite tomato sauce and pasta or in a meatball sandwich!

Glossary

bistro (<i>n.</i>)	a small, informal restaurant (p. 6)
coveted (<i>v.</i>)	to have wished for or wanted something very much (p. 3)
critics (<i>n.</i>)	people who find fault or carefully judge for review (p. 4)
culinary (<i>adj.</i>)	relating to food or cooking (p. 3)
implications (<i>n.</i>)	things that are understood without being expressed directly as a result of something else (p. 6)
ingredients (<i>n.</i>)	food items that go into a dish or recipe (p. 4)
investors (<i>n.</i>)	people, companies, or organizations that invest in something that may increase in value over time (p. 4)
prep (<i>v.</i>)	slang for prepare, to make something ready (p. 3)
reservations (<i>n.</i>)	bookings in advance for a room or seat (p. 4)
signature (<i>adj.</i>)	relating to a distinct characteristic or thing that identifies somebody (p. 5)

Reading a-z Running Record

Level U

Student's Name _____ Date _____

Magnificent Meatball Maker
149 words

Have the student read out loud as you record.

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page	E = errors S-C = self-correction M = meaning S = structure V = visual	E	S-C	E			S-C		
				M	S	V	M	S	V
3	Timmy checked his list to see what he still needed to prep. He had already peeled and minced 15 heads of garlic, cleaned and chopped 10 bunches of basil, and peeled 20 potatoes. All that was left to do was dice the roasted red peppers and make the rosemary marinade. Since Timmy's parents had divorced, he'd hung out at his Uncle Mario's Italian restaurant after school while his dad was still at work. But now Timmy prepped on Saturday afternoons like a real member of the kitchen staff. Mario's Kitchen was a casual neighborhood restaurant just eight houses away from Timmy's dad's house. But people came from far and wide to feast on Chef Mario's food-like ants swarming a picnic. The celebrity status that chefs such as his uncle enjoyed is something Timmy coveted. He wanted to cause his own neighborhood sensation and take the culinary world by storm.								
Totals									

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Mysteries of Flight

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Word Count: 1,324

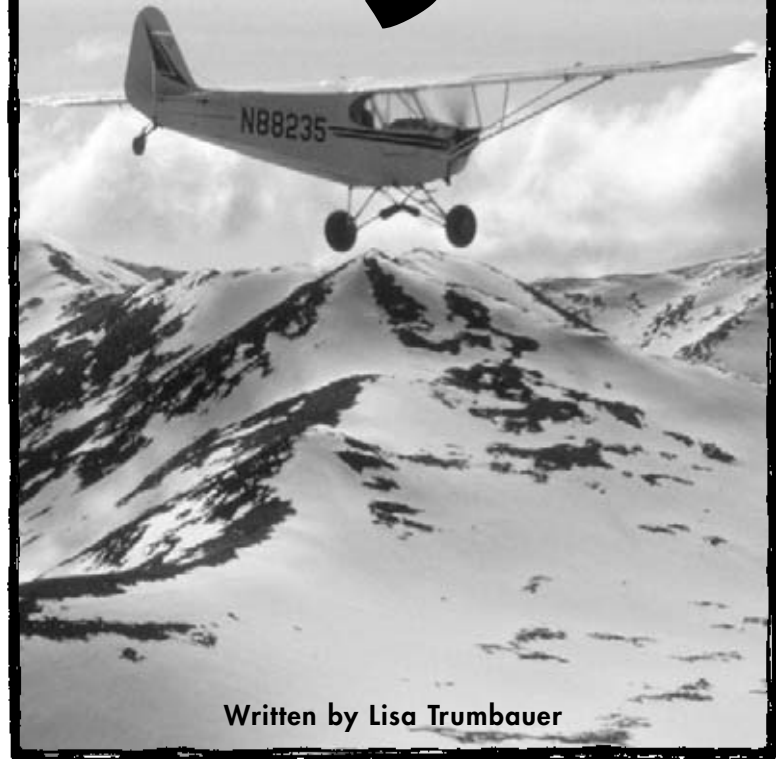


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Mysteries of Flight



Written by Lisa Trumbauer

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Mysteries of Flight



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Pages 7, 8 (right): © NASA; all other photos: © ArtToday.

Front cover: A single-engine plane flies over snowcapped mountains.

Back cover: The wings of a space shuttle create lift like an airplane's wings. However, a space shuttle has no engine, which makes it a glider and not an airplane.

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Table of Contents

Take Off	4
The Brothers Are Wright	6
The Plane Facts	9
The Big Mystery	12
Into the Air.....	15
Glossary	16
Index	16



The interior of a typical commercial airplane

Take Off

Imagine you are walking down a narrow aisle. A short row of seats lies on either side of you, with three seats on each side. Everyone around you is stuffing luggage into large compartments overhead, or they're pushing things under seats. You do the same, and then you scoot into your seat and buckle your seatbelt.

You continue to look around. You notice that the walls curve up toward the ceiling. The small plastic window beside you has a thick shade that you can lift and lower. People continue to walk down the aisle with more and more luggage.

And suddenly you wonder, "How is this big, heavy, metal tube, with all these people and all this stuff, ever going to get off the ground?"

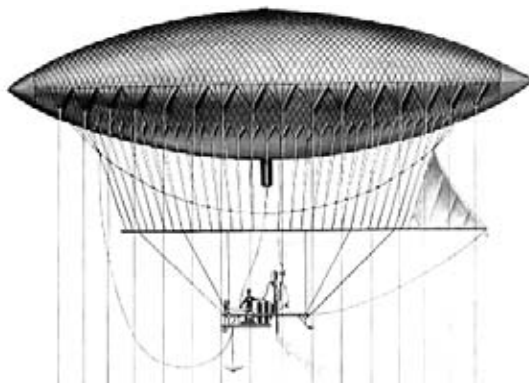
What you're really asking is, "How does an airplane fly?"

Throughout history, the question of how to fly, of how to soar through the sky like a bird, has intrigued and mystified people. After all, if birds can fly, why not humans? Some people even made wings that resembled those of a bird and attached them to their arms. Flapping their arms wildly, they soon discovered that homemade wings were not the key to human flight.

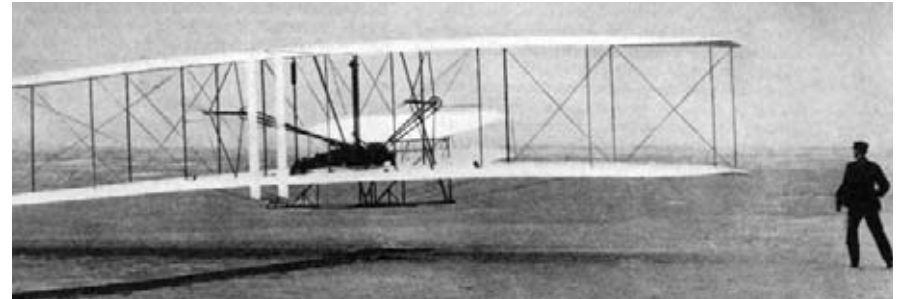
Then, in 1783, someone found a way to fly. In that year, two brothers in France figured out that hot air was lighter than cooler air. If they filled a giant balloon with hot air, the warmer air inside the balloon would rise above the cooler air surrounding it. Ingenious! With this discovery, the brothers proceeded to create the first hot-air balloon—and the first successful attempt at flight.

Over the next few decades, people continued to experiment with various methods of **aviation**. Slowly, these flying machines began to resemble

what would one day evolve into the modern airplane.



A drawing of Henri Giffard's hot-air ship, the first powered aircraft



Wilbur watches as Orville makes the first flight.

The Brothers Are Wright

Orville and Wilbur Wright were not scientists. In fact, the contraption they knew the most about was the bicycle. But, like so many others before them, Orville and Wilbur also were intrigued with the prospect of being able to fly.

The Wright brothers wanted to build a plane that could take off from the earth and keep itself flying through the air. They believed that the newly invented gasoline engine would be a key component to their dream of a flying machine.



The Wright Brothers

Wilbur Wright (1867–1912) and Orville Wright (1871–1948) grew up in Ohio. They owned a bicycle-repair shop in Dayton, Ohio. They introduced their powered airplane to people in the United States and Europe.

It was on December 17, 1903, when the Wright brothers pulled their newly created flying machine, called Flyer, onto a North Carolina field overlooking the Atlantic Ocean. The strange-looking contraption had a long pair of wings toward the front and a pair of shorter wings near the rear. The plane also had two propellers that were driven by a single engine.

Orville Wright stretched out on his stomach upon the lower wing and fired up the engine. As the propellers turned and the plane moved forward on two small wheels, Wilbur ran alongside, holding a wing to steady the plane. Within moments, the machine was airborne. To their delight, the invention was a success. They made three more successful flights that day, though none lasted more than a minute.



The longest flight on that eventful day at Kitty Hawk, North Carolina, lasted 59 seconds and flew 852 feet.

The Wright brothers continued to modify and experiment with their flying machines. Other people also worked with the Wright brothers' incredible design, hoping to build bigger, quicker, and better flyers.

Over the years that followed, airplanes became more complex and advanced. Even so, all airplanes, no matter how different in size or form, had some of the same basic parts that were on the Wright brothers' first plane—engines and wings.



Lindbergh



Earhart

Early Pilots

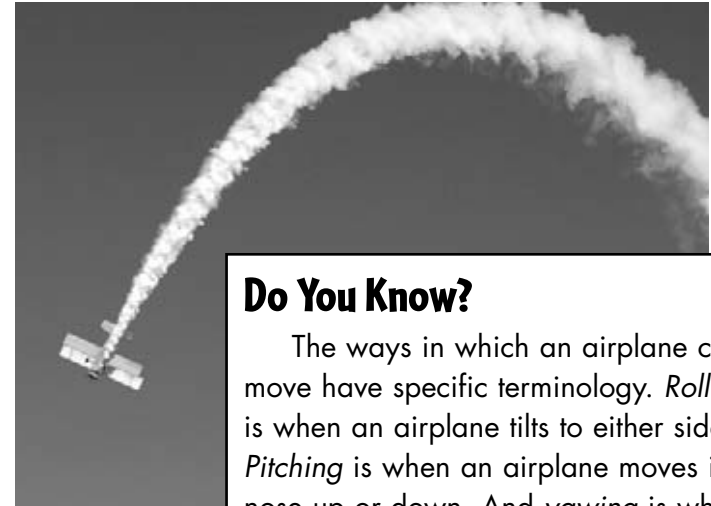
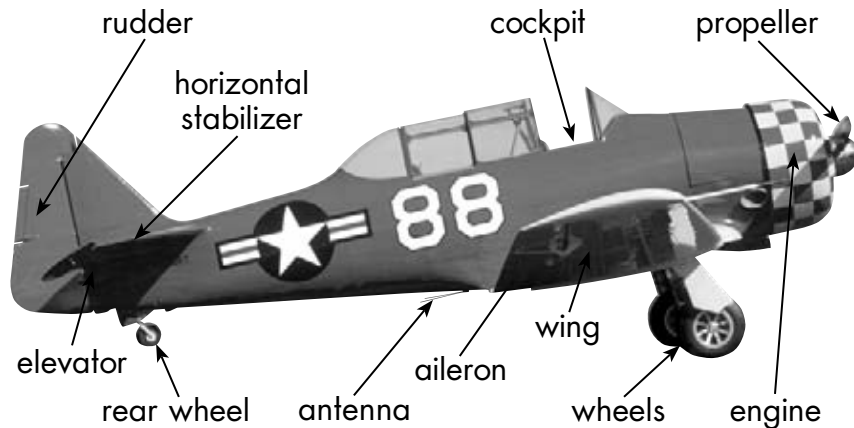
With the invention of the airplane, people began challenging themselves and their aircraft to see how far they could go. Two of the most well-known pilots of early aircraft were Charles Lindbergh and Amelia Earhart. In 1927, Lindbergh became the first person to fly solo across the Atlantic Ocean, taking off from New York and landing in Paris. Five years later, Amelia Earhart became the first woman to fly solo across the Atlantic.

The Plane Facts

In order to fly, all self-powered planes must have an engine. Like the engine of a car, the engine of an airplane moves the airplane forward. All airplanes must also have wings, because the wings are the feature that actually lifts the plane into the air. In addition, all airplanes must have parts on their wings that move. These moving parts, called **ailerons**, help control the airplane.

Planes have other parts that enable them to fly and that help pilots control their movements. A plane has a tail section with a **rudder** that moves right and left, and **elevators** that move up and down. The pilot is able to determine the movement of these parts with controls inside the plane's cockpit.

A Simple Single-Engine Plane



A stunt airplane

Do You Know?

The ways in which an airplane can move have specific terminology. *Rolling* is when an airplane tilts to either side. *Pitching* is when an airplane moves its nose up or down. And *yawing* is when a plane moves its nose left or right.

Controlling an airplane is almost like controlling a car, except that the pilot has an extra dimension to deal with. When driving a car or riding a bike, the driver or rider can make the vehicle go forward, as well as right or left. You can think of these directions as two dimensions—what's in front of you, and what's on either side of you.

An airplane, though, can move forward, right, left, as well as up and down. The pilot has the extra dimensions of the space below and above the plane in which to move. Controls inside the cockpit help the pilot maneuver through the air, conquering all these dimensions.

The inside of the cockpit is a jumble of gadgets, dials, and other gizmos. The control column is similar to the steering wheel on a car. Turning the column right or left moves the ailerons on the wings up or down, which causes the plane to tilt from side to side. The control column also can be pulled back and pushed forward, which will move the elevators on the tail up and down. When the elevators go down, the nose of the plane dips down, and when the elevators go up, the nose of the plane rises.



A pilot monitoring his many instruments

Some planes also have pedals that control the rudder. Pushing the right pedal moves the rudder to the right, which makes the nose of the plane turn right. Pushing the left pedal has the opposite effect, moving the plane to the left.



The wing of an airplane is the key to flight.

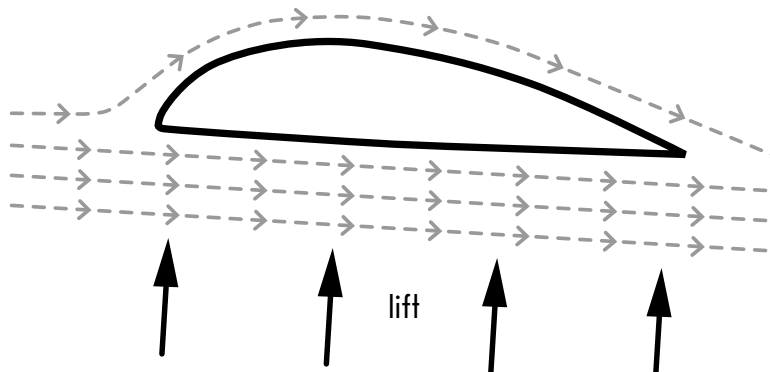
The Big Mystery

So now we know how a pilot controls the airplane, but the big question remains: How does an airplane fly?

If you compare the wings of different airplanes, you'll notice that, no matter to which airplane the wing is attached, all the wings have the same shape. This wing construction is the secret—and the science—behind what makes an airplane fly.

The upper surface of an airplane's wing is curved, and the bottom surface is flat. This means that air flowing across the upper surface has a greater distance to travel than the air moving across the lower surface. In order to keep pace with the air flowing under the wing, the air flowing over the top of the wing must move faster.

The faster the air moves, the less pressure it exerts. The slow-moving air beneath the wing exerts greater pressure on the wing's lower surface than the fast-moving air exerts on the wing's upper surface. The greater pressure under the wing pushes the wing upward. This upward push of air, called **lift**, causes a plane to leave the ground and fly.



Air moving over the top of a wing moves farther and faster than air under the wing.



An airplane engine up close

Because moving air causes these different air pressures, the airplane's engine is critical for it to fly. Without an engine, a plane would not move forward through the air. The forward motion makes the air flow over the airplane's wing and creates the differences in pressure—it creates the lift needed for the plane to overcome gravity. As long as the engine pulls the plane forward, the airplane will remain airborne.

Into the Air

As you imagine yourself sitting inside an airplane and gazing out the window, don't think about how heavy the airplane is, loaded down with people and cargo. Instead, notice the shape of the wings and consider the air flowing over them. The Wright brothers did! And because of their **speculation** and experimentation with wing shape and engines, the airplanes of today are able to take us just about anyplace in the world.

Where would you like to go?



Airplanes line up before take-off.

Glossary

ailerons (<i>n.</i>)	moving parts on an airplane's wing that help control the amount of lift (p. 9)
aviation (<i>n.</i>)	human flight in airplanes (p. 5)
elevators (<i>n.</i>)	flaps on an airplane's tail that help the plane move up and down (p. 9)
lift (<i>n.</i>)	a force that pulls things up into the air (p. 13)
rudder (<i>n.</i>)	a vertical flap on the back of an airplane or ship that helps it turn (p. 9)
speculation (<i>n.</i>)	using facts to guess what might happen next (p. 15)

Index

Amelia Earhart, 8	invention, 7
cockpit, 9, 10, 11	Kitty Hawk, 7
contraption, 6, 7	propeller, 7, 9
dimension, 10	yawing, 10
hot-air balloon, 5	

Reading a-z Running Record

Level U

Student's Name _____ Date _____

Mysteries of Flight
137 words

Have the student read out loud as you record.

Assessed by _____

page	E = errors S-C = self-correction M = meaning S = structure V = visual	E	S-C	E			S-C		
				M	S	V	M	S	V
4	Take Off Imagine you are walking down a narrow aisle. A short row of seats lies on either side of you, with three seats on each side. Everyone around you is stuffing luggage into large compartments overhead, or they're pushing things under seats. You do the same, and then you scoot into your seat and buckle your seatbelt. You continue to look around. You notice that the walls curve up toward the ceiling. The small plastic window beside you has a thick shade that you can lift and lower. People continue to walk down the aisle with more and more luggage. And suddenly you wonder, "How is this big, heavy, metal tube, with all these people and all this stuff, ever going to get off the ground?" What you're really asking is, "How does an airplane fly?"								
Totals									

Accuracy Rate:

Error Rate:

Self-correction Rate:

The Mighty Saguaro Cactus

A Reading A-Z Level U Leveled Reader

Word Count: 1,530



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Level U Leveled Reader
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LEVEL U	
Fountas & Pinnell	Q
Reading Recovery	24
DRA	40

Table of Contents

One Cool Cactus.....	4
Up Close and Personal	7
Surviving the Sonoran Desert	9
The Cactus Hotel	12
Sweet Desert Desserts	14
The Cycle of Life	15
The Modern Saguaro	17
Digging Deeper.....	19
Glossary	20

One Cool Cactus

Imagine you are 14 years old but only as tall as a pencil. You don't have any arms. When you turn 60, your first arm grows. Another arm grows, and then another. One day you realize you have nine arms. You are now 150 years old and as tall as a three-story building.



What if flowers grew from your head? What if your ribs were made of wood? And let's say you were green with sharp spines. Does that seem strange to you? That's what it would be like to be a saguaro.

How old might this saguaro be?

Try to Say It!

Can you say *saguaro*?

Imagine that the *gu* is a *w*.

Try saying it like this:

suh-WAR-oh. Saguaro. suh-WAR-oh.

A saguaro (*Carnegiea gigantea*) is a giant green **cactus** with a round trunk and curved arms. People often think that saguaros look like humans. Many saguaros look as though they are waving, and some appear to be dancing. But despite how they look, they all stand silently through the day and night.

The saguaro cactus is the silent keeper of desert secrets. From above, this green giant witnesses many lives. Bees buzz by, snakes slither past, and coyotes hunt and howl under a full moon.



Would you care to dance?

An old saguaro has watched human history **evolve**. People invented cars, then televisions, and then computers. Many old saguaros have even watched the ownership of their very land change from one country to another!



What parts of history might this saguaro have seen?

In this book, you will learn more cool things about the saguaro. You will learn where it lives and how it survives. You will also read about different animals that check into this cactus hotel. By the end, you may even imagine the taste of saguaro candy in your mouth!

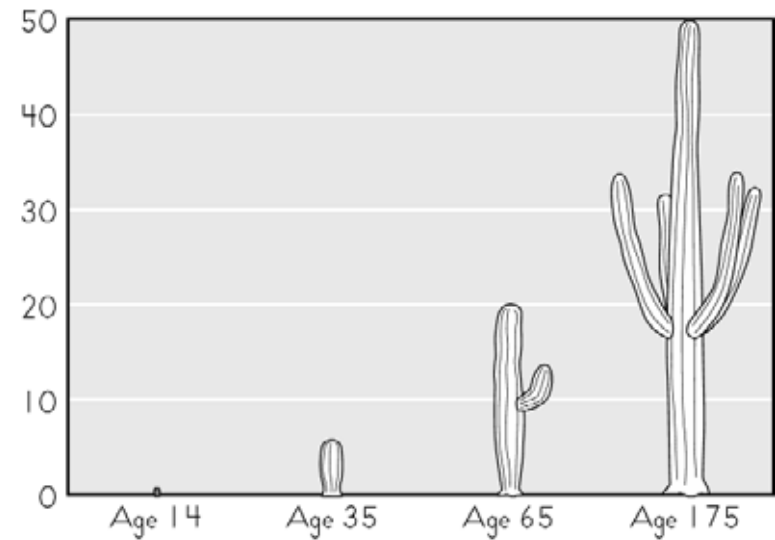
Up Close and Personal

The saguaro grows only in the Sonoran Desert. It cannot be found anywhere else in the world! Though, even in the Sonoran Desert, it cannot grow everywhere. The saguaro needs enough water to grow and protection from freezing temperatures. It usually grows on land between sea level and 4,000 feet (1,219 meters) above sea level. This area provides the saguaro with the conditions it needs to grow.

The saguaro also needs to protect itself from other desert dangers. It grows thousands of two-inch spines on its body. These sharp spines prevent animals from eating it. Spines also are the saguaro's silent way of saying, "Don't knock me down!"



Saguaro spines grow in clusters.



This bar graph shows (in feet) the slow, tall growth of the saguaro.

A saguaro grows very slowly. At age 14, it is still a baby and only as tall as a pencil. A baby saguaro normally grows under a nursing plant like a palo verde. The nursing plant protects it from the sun, wind, and animals.

A saguaro will not grow its first flower until the age of 50. The cactus may grow many arms and hundreds of flowers. It will grow its first branch, or arm at 60. The height of a 200-year-old saguaro may extend more than 50 feet (18 meters) above the Sonoran Desert surface.

Surviving the Sonoran Desert

The Sonoran Desert is hot—a summer day can reach a scorching 120° F (49° C)! The Sonoran Desert is also dry. Months can pass without a single drop of rain.

What if you didn't drink a drop of water for months—wouldn't you get thirsty? Like people and other animals, plants need water to live. Water is scarce in the desert.



The Sonoran Desert is located in North America. People from Mexico, the United States, and several Native American nations call the Sonoran Desert home.

But when it does rain, it rains hard. Half of the year's rain falls in just two months. These late summer monsoon storms bring strong winds and lots of lightning. It rains so fast and hard that dry streambeds and riverbeds quickly become raging torrents of water, and streets quickly flood.

The saguaro is an expert water collector. Its long, shallow roots spread out in all directions just below the ground's surface. When it rains, these roots soak up tons of water, which the saguaro stores inside its trunk and arms.

Many plants lose water through their leaves. Just as people sweat, plants **transpire**. But the saguaro has spines instead of leaves so it doesn't lose as much water. The saguaro's skin is tough and waxy. This also helps to keep water inside.



Saguaros expand like sponges when they soak up rainwater.

Do You Know?

The word "cactus" has two plural forms: *cactuses* and *cacti*. Many people from the Sonoran Desert say *cacti*: One cactus, two cacti, three cacti, four . . .



This owl is just one of many animals that lives in the Sonoran Desert.

Survival in this desert is tough. Animals and plants must find enough water to live, and they must protect themselves from the extreme weather. They also must defend against hungry animals.

Many plants and animals have adapted well to the Sonoran Desert. Humming birds, doves, and quail fly about. Coyotes, rabbits, and snakes also live here. Many types of bushes, trees, and other cacti grow here as well.



Gila woodpeckers make their home in this saguaro.

The Cactus Hotel

The saguaro is a center of activity for many desert animals. This **hospitable** cactus has free rooms for birds, lizards, and insects. These rooms are cool in the summer, and they have pretty views.

Every spring, the Gila woodpecker chisels out a new home inside a saguaro cactus. First the woodpecker makes a narrow entrance. Then it hollows out a deep room.

Inside this room, the female lays her eggs. The nest is high above the desert floor. The saguaro's sharp spines help to protect the baby birds. Inside the saguaro they will be safe from **predators**. When the woodpecker family moves out, tiny owls or other birds will move in.

Hawks may build their nests high in the saguaro (see title page). These nests, made of twigs and grass, rest on the arms of the giant cactus.

The saguaro attracts other desert animals as well. It serves up free flowers, nectar, and fruit.

In late spring, the saguaro produces flowers that are white with yellow centers. They grow on the tips of the saguaro's arms and trunk. A summer saguaro looks as if it is holding flowers in its hands. Around its head is a flowery crown.

A saguaro's flowers open for a short time at night and close during the heat of the day. When the flowers open, birds, insects, and bats drink the flowers' sweet nectar.



Bees drink nectar and help spread pollen.

While drinking, these animals get dusted with pollen. Then they fly to the next flower and spread the pollen. This is what **pollinates** saguaro flowers and makes the fruit grow.

Saguaro fruit is red with black seeds. Birds like to eat this sweet fruit. Sometimes saguaro fruit falls to the ground. Foxes, coyotes, and **javelinas** enjoy these sweet summer treats.

Sweet Desert Desserts

The Tohono O'odham (tah-HOE-na AUT-um) people have lived in the Sonoran Desert for hundreds of years. The saguaro cactus is an important part of their lives.

In the past, they left their villages every summer and moved into cactus camps for a few weeks. These camps were located near the mighty saguaros.

Women and children harvested the ripe fruit using the long wooden ribs of dead saguaros. Women knocked the fruit down, and children collected it in baskets.



Reaching up high to harvest the fruit of the saguaro

Back at the camp, the women would boil the fruit in water, and then they would filter it. Next, they poured the sweet syrup into clay jugs. Finally, they carried the jugs back to their villages.

The Tohono O'odham still make saguaro jams, candies, and wine. They use the wine for a special rain ceremony.

The Cycle of Life

Every saguaro begins its life as a small seed on the ground. When the seed **germinates**, roots grow. The baby saguaro begins to grow under a nursing plant, and over time, the cactus grows high above the desert floor.

Like all plants and animals, saguaros will die. They grow old, and their life ends. However, some saguaros die before old age. They may freeze on cold nights, or they may become infected with diseases. A few **unfortunate** saguaros get struck by lightning.



A palo verde tree (left) often serves as a nursing plant for saguaros.



Saguaro ribs are a shadow of the mighty saguaro that once lived.

When a saguaro dies, its fleshy skin falls to the ground. Termites, scorpions, and lizards burrow new homes inside of it. Slowly, the body of the saguaro **decomposes**, and it turns back into desert soil. The saguaro's wooden ribs often remain standing like a **tribute** to the cactus's life. But after a while, these ribs also fall down.

Entrance to Saguaro National Park near Tucson, Arizona, USA (right)

Arizona license plate (below)



The Modern Saguaro

The mighty saguaro has come to symbolize the Sonoran Desert. It shows up on postcards, in movies, and on Arizona license plates.

The saguaro even has a park named after it! Saguaro National Park near Tucson, Arizona, is the home of many beautiful saguaros. Visitors from all over the world come to see these mysterious giants. They take photographs of themselves with the saguaros. Some tourists like to hike on park trails and enjoy the beauty of the saguaro in their Sonoran desert home.

Today, there are laws to protect saguaros. In certain places you cannot dig them up without a permit. If you do, you can be fined. When new roads are built, saguaros are moved to keep them safe.

These are just some of the secrets of the mighty saguaro. Other stories may never be known. But one day you might visit the Sonoran Desert. You might walk out into the desert's silence and sit next to a saguaro. You might carefully touch its tough skin and stare up at its huge green arms. You might picture the animals that have eaten its fruit.

You might even scratch your head and try to guess its age. You might wonder, "Will it still be standing here when I am old and gray?" If nothing else, perhaps you will just sit and enjoy the sunset. If you listen long enough, maybe the saguaro will whisper some of its secrets.



A photographer captures the saguaros at sunset.

Digging Deeper

Did you like learning about the saguaro cactus? Are you interested in learning more cool things? If so, keep reading!

1 At the Library

Tell your librarian that you are interested in books about the Sonoran Desert. These books will have pictures of desert animals, such as rattlesnakes, roadrunners, and coyotes. The books will talk about saguaros, too.

2 On the Web

- In the address window, type: *www.google.com*
- Then type: *saguaro cactus*. Click on “Google Search.”
- Read the colored links. Click on one that looks interesting.
- When you want to explore other links, click the “back” arrow on the top left.
- Or try a new search: *Sonoran Desert*.

3 Try This!

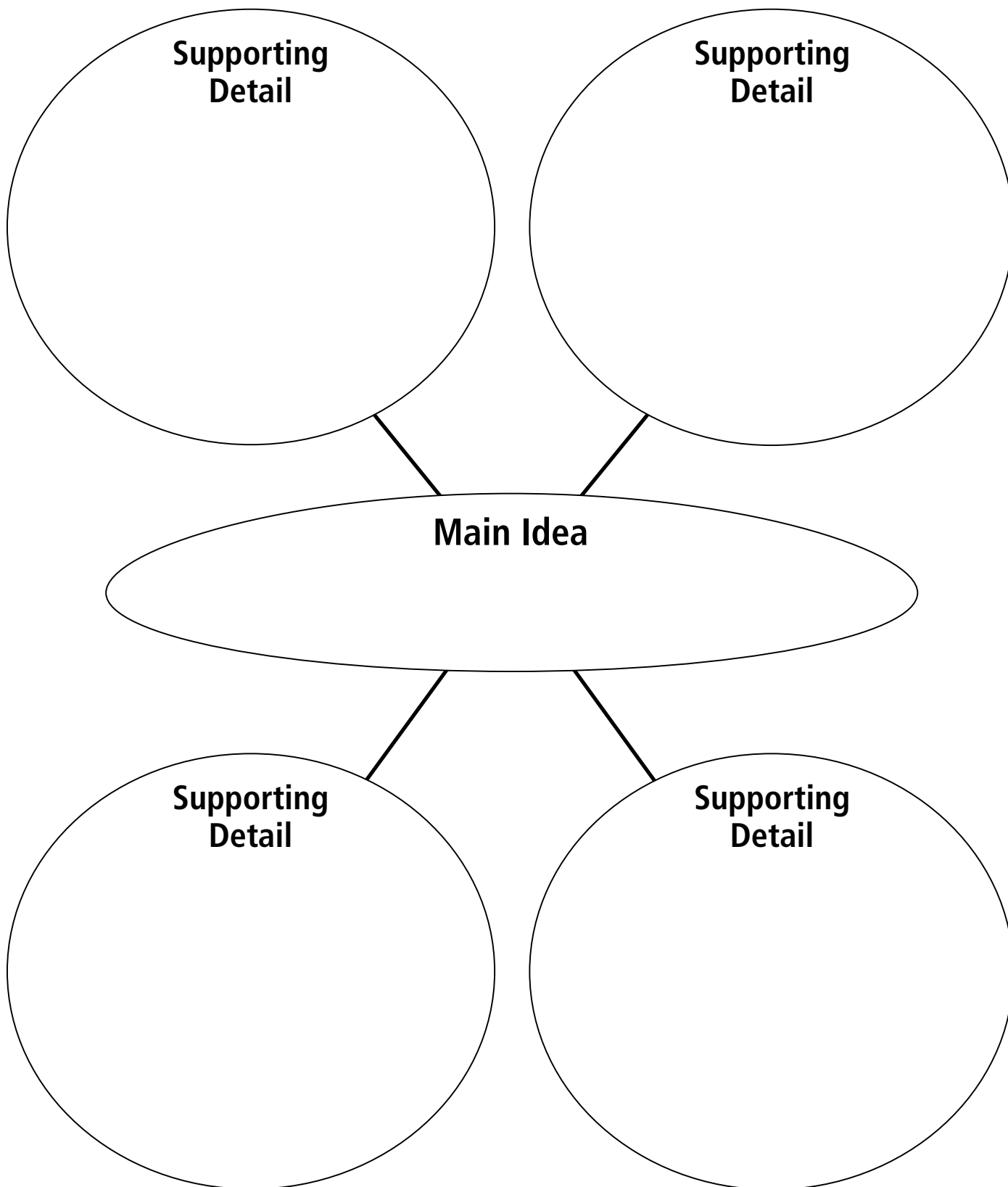
Do you believe that plants sweat? Tape a plastic bag tightly around the end of a bush or tree branch. Make sure there are leaves inside. After two days, come back and see if there is water in the bag. Be careful if you try it with a cactus—you might get poked!

Glossary

cactus	a thick plant native to dry parts of the world that usually has spines instead of leaves (p. 5)
decompose	to decay, rot, or break down into small parts (p. 16)
evolve	to change or develop over time (p. 6)
germinate	to begin to grow from a seed and become a new plant (p. 15)
hospitable	friendly and welcoming to strangers or guests (p. 12)
javelina	a pig-like animal that lives in the Americas (p. 13)
pollinate	to put pollen in a flower and fertilize it (p. 13)
predator	an animal that naturally hunts or preys on others (p. 12)
transpire	to give off water vapor. A plant lets out water through its leaves. (p. 10)
tribute	an act or statement that shows gratitude or respect (p. 16)
unfortunate	unlucky (p. 15)

Name _____

INSTRUCTIONS: Write the main idea in the center of the web. Record the supporting details in the surrounding circles.



THE MIGHTY SAGUARO CACTUS • LEVEL U • 1

SKILL: MAIN IDEA AND DETAILS

Name _____

INSTRUCTIONS: : Choose the correct subject or verb for each sentence from the parentheses and write the word on the line.

1. The saguaro _____ water in its arms and trunk.
(store, stores)
2. Many _____ make their nests in saguaros.
(bird, birds)
3. The baby birds _____ from predators there.
(hide, hides)
4. She _____ it is a treat to see a baby owl.
(feel, feels)
5. They _____ silently through the day and night.
(stand, stands)
6. Many _____ lose water through their leaves.
(plant, plants)
7. _____ build nests high in the saguaro.
(Hawk, Hawks)
8. Saguaro flowers _____ for a short time at night.
(open, opens)
9. The _____ falls to the ground.
(skin, skins)
10. The _____ whispers some of its secrets.
(saguaro, saguaros)



Name _____

INSTRUCTIONS: Use one of the homophones from the box to complete each sentence.

there	they're	their
-------	---------	-------

1. _____ are sharp spines on the saguaro's trunk.
2. Summer Saguaro have flowers on _____ arms.
3. _____ are very hot days in the Sonoran Desert.
4. _____ taking lots of water on their hike.
5. The Tohono O'odham sell _____ jams and candies to tourists.
6. _____ going to go hiking to see the saguaro cacti in the desert.
7. _____ the largest cacti in the desert.
8. The tourists are having _____ pictures taken standing next to a saguaro.
9. The coyotes howl _____ lonesome song.
10. Don't sit _____ without looking for snakes.



The Amazing Amazon

A Reading A-Z Level U Leveled Reader

Word Count: 2,176

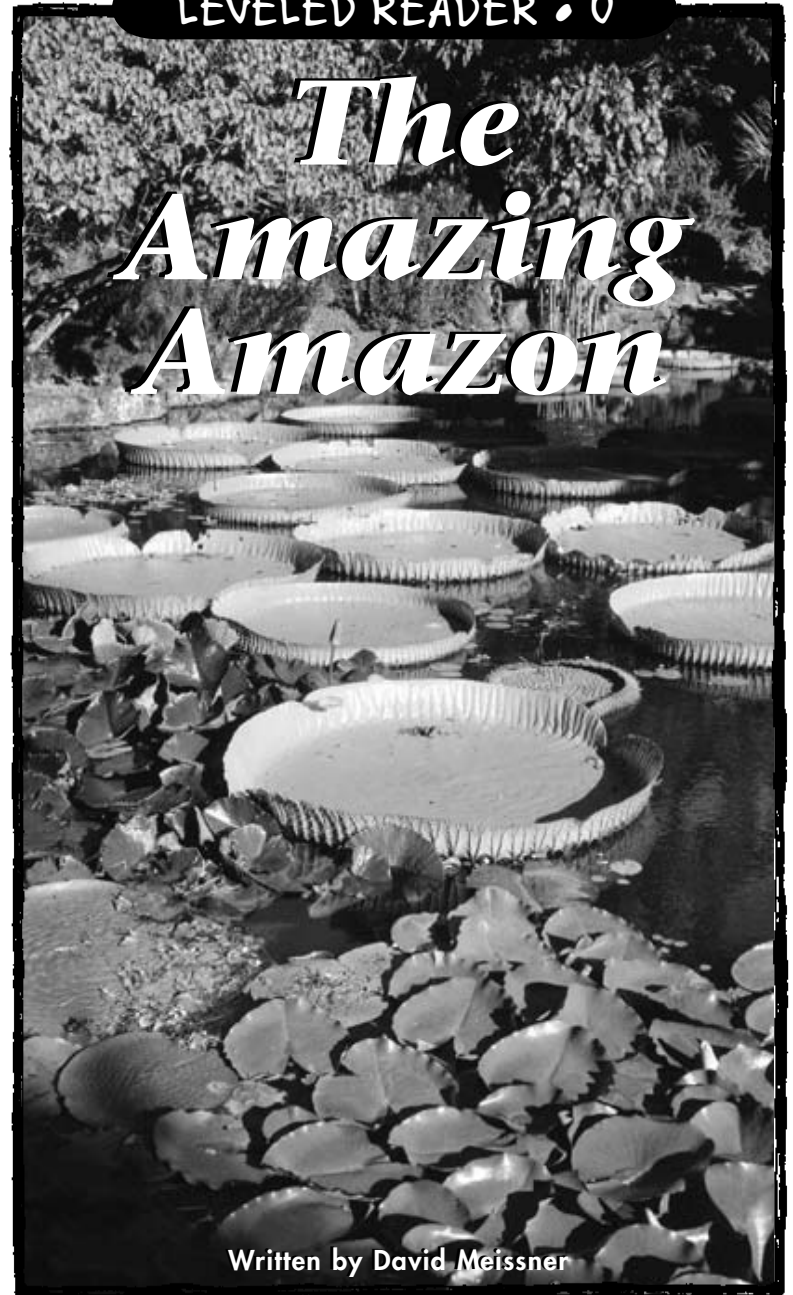



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LEVELED READER • U

The Amazing Amazon



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LEVEL U	
Fountas & Pinnell	Q
Reading Recovery	24
DRA	40

Table of Contents

Chapter 1: There Is a Place	4
Chapter 2: Layers of the Rainforest.	10
Chapter 3: Keeping It Clean.....	18
Chapter 4: Who, Me?.....	20
Explore More	22
Glossary.....	24

NOTE: Rainforest can be spelled in two ways: *rainforest* or *rain forest*. We will use the one-word spelling. And when this Leveled Reader uses the word *rainforest*, it means tropical rainforest.



In the Amazon rainforest

Chapter 1: There Is a Place

There is a place where monkeys swing and howl.
There is a place where jaguars leap from tree to tree.
In this place, bananas and pineapples grow for free.
In this place, tiny frogs live in flowers. This is where
pink-colored dolphins swim in the river. This is
where storms come often, and where the air is sweet.

Some sunlight filters through the vines and leaves,
but it is mostly dark here on the ground.
It is hot, steamy, and surprisingly still. Rainwater
trickles down from leaf to leaf. You hear a slow
sound: drip, drip, drip.

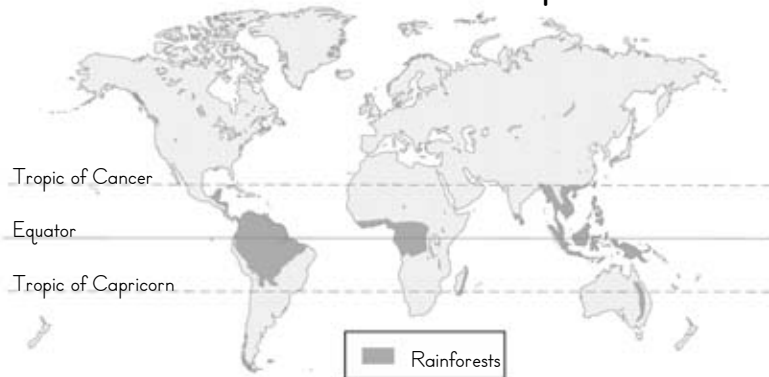
Your skin is sweaty. An insect lands on your neck.
An ant quietly walks across your sandal. Suddenly
a little brown monkey swings to a nearby branch.
Then a bright green bird flutters past. Welcome to
the Amazon rainforest.

Rainforests

Tropical rainforests live up to their name: They are forests where it rains a lot. In fact, a typical tropical rainforest receives between 150 and 400 centimeters (55–160 in.) of rain each year. They are also warm. Their temperature averages between 25° and 35° Celsius (77°F–95°F). Rainforests are green year-round. Their hot, humid, and rainy climate is perfect for tall trees, vines, ferns, and other plants. The really thick part of rainforests is what we call “jungle.”

Tropical rainforests cover a small part (about 6 percent) of the earth’s surface. But over half (50 percent) of the world’s plant and animal **species** are found in them! Rainforests usually lie in tropical areas near the Earth’s equator. Most of the world’s rainforests are in Africa, Southeast Asia, and South America.

World Rainforest Map



The rainforest’s dense foliage

The Amazon

The Amazon rainforest lies in South America. It is the largest tropical rainforest in the world. It has more kinds of insects, plants, and animals than any other place on Earth. Every year, scientists discover new species of insects and plants here.

The Amazon River flows through the heart of this rainforest. It is like a huge sea of fresh water. Thousands of other rivers and streams empty into it. Catfish, **piranhas**, and dolphins all live in the Amazon River.

This Leveled Reader will take you on a tour of the Amazon rainforest. You will travel from the tallest trees to the rainforest floor. Along the way, you will meet an eagle, monkey, jaguar, and ant. You will even hear what these Amazon natives would say—if they could talk.

Map of Amazon Basin



So just how big is the Amazon River?

- The Amazon River is 56 kilometers (35 mi.) across at its widest point.
- It flows 6,437 kilometers (4,000 mi.) to the Atlantic Ocean.
- Within its mouth is an island the size of Switzerland.
- The river's Arapaima fish can grow to be 3 meters (10 ft.) long and weigh 136 kilograms (300 lbs.)!



The Amazon is the world's widest and largest river. Its **volume** is greater than the next eight largest rivers combined!

From the Amazon Yearbook



**Sammy "Slowpoke"
Sloth**

Sloths are slow-moving animals. They seem to just hang out (upside down!) in the trees. Sloths get covered in algae, which helps them blend into the forest.

Sammy was voted:
*Most Likely to Survive,
but Least Likely to
Succeed*



**Tamara
the Tapir**

The tapir is a big hoofed animal that is related to the horse and the rhinoceros. Tapirs often weigh well over 136 kilograms (300 lbs.). Tapirs like to take baths in the river and look for food when it is dark.

Tamara was voted:
Best Personality

From the Amazon Yearbook

At 1.2 meters (4 ft.) long, the capybara is the world's largest rodent. (But Katie doesn't like to be called a big rat.) Capybaras' webbed feet help them swim.



Katie Capybara

Katie was voted:
*Most Likely to Win
a Rat Race*

The poison arrow frog has super-bright colors (this one is red). These colors warn other animals that its skin is poisonous. Indians in the Amazon rainforest dip their arrows into this poison for hunting.

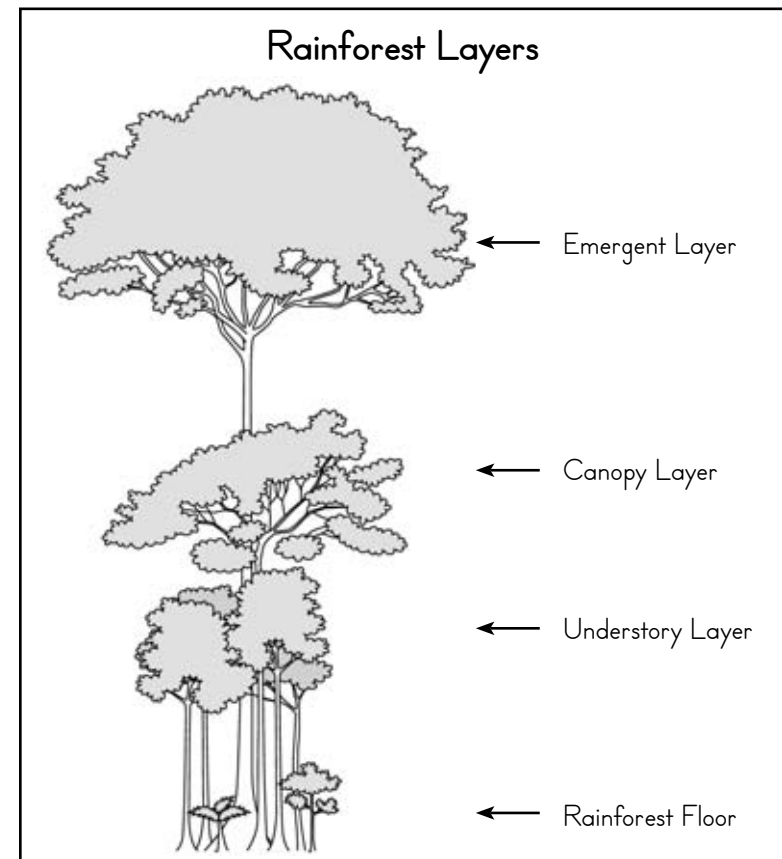


**Paulo the
Poison Arrow Frog**

Paulo was voted:
*Most Dangerous
Amphibian*

Chapter 2: Layers of the Rainforest

To better understand the rainforest, scientists have “divided” it into four layers, or sections. You can think of it like a four-story building. The highest trees make up the top floor, or the emergent layer. The next highest trees make up the canopy layer. Below them is the understory layer. At the bottom is the rainforest floor.



High Risers The tallest trees of the rainforest are called the emergents. They are like big umbrellas that rise high above the thick forest. Emergents are exposed to lots of sun, wind, rain, and lightning.

Big roots support these giant trees. Because rainforest soil is shallow, tree roots often grow above the ground. The kapok tree, for example, has roots that extend out like wooden walls. These roots are so big that your whole class could hide behind just one of them!

Not many animals live in the emergent layer. Some birds and butterflies do visit to eat leaves and fruit. One huge bird, the harpy eagle, actually lives up there, high above the Amazon.



Harpy eagle

SPOTLIGHT INTERVIEW:

The Harpy Eagle

RAZ Interviewer: Hello there, Harpy. Is it true that you are the largest eagle in the world?

Harpy: I think so. In your people terms, I am about one meter tall, which is over three feet high.

RAZ Interviewer: It looks like you have some big wings as well.

Harpy: Oh, these things? I was born with these. If I stretch them out like this, they are longer than most people. You see? My wingspan is two meters across—about six and a half feet. Flying fast really helps me find food.

RAZ Interviewer: What is your favorite food?

Harpy: Oh, I like pizza delivered to my door. Just kidding—there's no pizza here in the rainforest! I hunt sloths, monkeys, and fellow birds. Monkeys are probably the tastiest.

RAZ Interviewer: Is that what your big **talons** are for?

Harpy: Yep. These yellow meat hooks can scoop **unsuspecting** animals right off of tree branches.

RAZ Interviewer: Do you ever fear revenge, like a monkey uprising?

Harpy: No, I'm the top bird around here. I build my stick nests in the tallest trees where monkeys don't normally go. Hey, there's a monkey now! I'll see you later!

Crazy Canopy The rainforest's real action is in the canopy layer. This is where most plants and animals live. It is like a thick roof woven out of tree branches, plants, and vines.

Many trees in the canopy are covered with climbing vines and epiphytes. **Epiphytes** are plants that grow on top of others. Most of the rainforest's flowers, fruit, and seeds are found in this layer.

With so much good canopy food, it makes sense that animals hang out here. Many animals rarely come down to the ground. They eat, sleep, hunt, and give birth high up in the trees. Sloths, toucans, and parrots are just some of the canopy's **residents**. The hardest one to ignore is probably the howler monkey. Its name befits its behavior, as these monkeys howl and scream to keep other animals out of their territories.



Bromeliads are cone-shaped plants that grow on trees. Their cones catch a lot of rainwater and form little swimming pools high above the ground. Tiny frogs, salamanders, and crabs live in these pools. Mosquitoes and dragonflies lay eggs in them.

SPOTLIGHT INTERVIEW:

The Howler Monkey

RAZ Interviewer: Wow, that was one loud howl! Excuse me, but could you please stop screaming for one moment? I would like to ask you a few questions!

Howler: Okay, but hurry up. If I don't scream like this, other monkeys may come into our territory.

RAZ Interviewer: Do you always stay up here in the canopy?

Howler: This is our home, my man. On the ground, there are some really big animals—it's a jungle down there. When it comes to safety, we don't monkey around. Up here, we can eat fruit, leaves, and flowers, and we can live in safety.

RAZ Interviewer: Does your long tail help you? It looks **prehensile**.

Reaching the Top

Scientists have found creative ways to study the top layers of rainforests. They have climbed with ropes and ladders. They have built platforms like tree houses. Some have gone up in cranes. A blimp has even lowered a raft of scientists down to the canopy.



Howler monkey

Howler: Yeah, if by prehensile you mean “grab onto.” My tail helps me climb, but my hands and feet are very useful for climbing, too.

RAZ Interviewer: You sure use big words for a monkey. Hey, stop the howling! If you can be heard from miles away, just think how loud it is for me. What makes you so loud anyway?

Howler: I have a special bone in my windpipe. My throat is like a hollow sound box. See the big swelling under my chin? Here, touch it.

RAZ Interviewer: Oww! That’s not funny—you have sharp teeth! Okay Mr. Monkey, you can go back to howling now.

The Darker Story The “understory” is the third level of the rainforest. It is below the canopy and above the ground. This is where ferns, plants, and young trees grow. It is dark in the understory because very little light shines through the thick canopy. Understory plants grow leaves that are big and wide. That way, they have a better chance of catching some rays.

Animals like to eat these big leaves. The understory is not nearly as busy as the canopy, but animals do live here. Poison arrow frogs hide in



Jaguar

the **foliage**. Snakes wrap around trees like vines. Birds peck and pull insects from the wood. Large cats like jaguars leap between branches.

SPOTLIGHT INTERVIEW:

The Jaguar

RAZ Interviewer: Hey, put me down! And don't bite. Bad cat, bad big cat!

Jaguar: Sorry, I thought you were a monkey. Lucky you're not as tasty. Hey, what do you think you're doing here anyway?

RAZ Interviewer: I came to interview you, the biggest cat in the Americas. Mr. Jaguar, are you really 2.6 meters (8.5 ft.) long?

Jaguar: That's what they say. And I weigh 136 kilograms (300 lbs.), too. Not many animals mess with me. By the way, you can just call me Jag.

RAZ Interviewer: Okay, Jag, what do you do for exercise?

Jag: I get bored with just one sport. That's why I cross-train: I run, swim, climb, fish, and hunt.

RAZ Interviewer: What do you hunt?

Jag: Lots of things. Sometimes I climb up in the canopy to eat sloths and monkeys. On the ground, I hunt **peccary**, tapir, and yummy capybaras. On lazy days, I lie near the river and catch fish with my claws. When I'm really hungry, I kill alligators.

RAZ Interviewer: Wow, I don't want to be in your powerful jaws ever again! If you'll excuse me, I need to go now.

Chapter 3: Keeping It Clean

If you walked around the rainforest floor, you might be surprised. It is not just one thick jungle. Sure, you would see roots, ferns, herbs, and baby trees. But most of the green would be high above you. The ground itself would look surprisingly clean, almost as if somebody had swept it.

But the clean rainforest floor is no accident—millions of little creatures clean it every day! Earthworms, termites, fungi, and bacteria eat up the fallen fruit, leaves, and branches. They recycle it back into nutritious soil. When a big tree falls, they quickly munch it down into small pieces.

Also on the ground are big animals like deer, tapir, peccary, and capybara. But they are far outnumbered by the smaller spiders, beetles, and ants. Ant highways crisscross the rainforest floor. One kind of ant even parades around with leaves and flower petals in its mouth. It is the famous leaf-cutter ant.

Trivia Question

In the Amazon rainforest, are there more mammals, birds, insects, or reptiles?

Answer: Insects! (There are more than 200 types of mosquito alone. There are well over 1,000 different kinds of butterflies. And just think of all the ants!)

SPOTLIGHT INTERVIEW:

The Leaf-cutter Ant

RAZ Interviewer: Hey down there! Yeah, you—the one carrying the big leaf over your head! I'd like to ask you a few questions. Do you have a moment?

Ms. Ant: Sure, but I do need to hurry back to the **fungus** garden. We're low on food.

RAZ Interviewer: Did you really just climb up a tree and cut off that leaf?

Ms. Ant: That's correct. And now I'm carrying it back to our underground colony. That's where smaller ants will chew it up into little spongy bits.

RAZ Interviewer: So you don't eat the actual leaf?

Ms. Ant: No, we use the leaves to grow fungus. Then we eat the fungus. Want to try some?

RAZ Interviewer: No, thank you—I, uh, just had lunch. So tell me, what is it like underground?

Ms. Ant: We have deep nests with hundreds of chambers. In the middle rooms, small ants tend to our fungus gardens. Our only queen is in a different room. She can lay up to 30,000 eggs in one day. That's why there are almost eight million of us here! Now if you'll excuse me, I need to sniff my way home. And please watch your feet—if you step on our trail, I might get lost!



Leaf-cutter ants



Chapter 4: Who, Me?

Yes, you. Do you eat bananas? Do you like chocolate? Have you ridden a bicycle with rubber tires? Well, guess what? Bananas, chocolate, and rubber all grow in the Amazon rainforest. Many more things come from the Amazon, too, like medicines, wood, pineapples, and fresh air.

The Amazon is a rich, living treasure. Insects buzz by that do not even have names yet. Trees grow, fall, and turn back into soil. Rainstorms fill up frogs' swimming pools. And perhaps most importantly, plants of the rainforest take carbon dioxide from the air and replace it with oxygen. Humans and other animals need oxygen in order to live.



The Amazon rainforest is home to many living things.

The Amazon rainforest is a real place. Even if it is far away from you, the Amazon lives at this very moment. As you read these words, a jaguar slinks through the understory. Right now, a leaf-cutter ant marches back to a fungus garden. Somewhere in the Amazon, the scream of a howler monkey echoes throughout the forest. Can you hear it?

Explore More

Did you like learning about the Amazon rainforest? Well, there is much more to see. If you do some research, you're bound to find some very interesting animals!

1. At the Library

Tell your librarian that you are interested in books about the Amazon rainforest.

2. On the Web

In the address window, type: *www.google.com*

Then type: *Amazon rainforest*. Click on "Google Search."

Read the colored links. Click on one that looks interesting.

When you want to explore other links, click the back arrow on the top left.

Or try a new search: *Amazon River*



Capybara

3. Try This!

Where do you live? Do you live in the rainforest? What about in a desert, tundra, or pine forest? Do you live on the coast, up in the mountains, or out on the plains? You must live somewhere, right?

If we live in a town or city, sometimes it can be hard to tell what kind of region we live in. But there are clues all around. What kinds of trees and bushes grow nearby? What kinds of birds fly overhead? What is the weather like? Look around and investigate. If you are not sure, ask your teacher, librarian, parent, or friend.

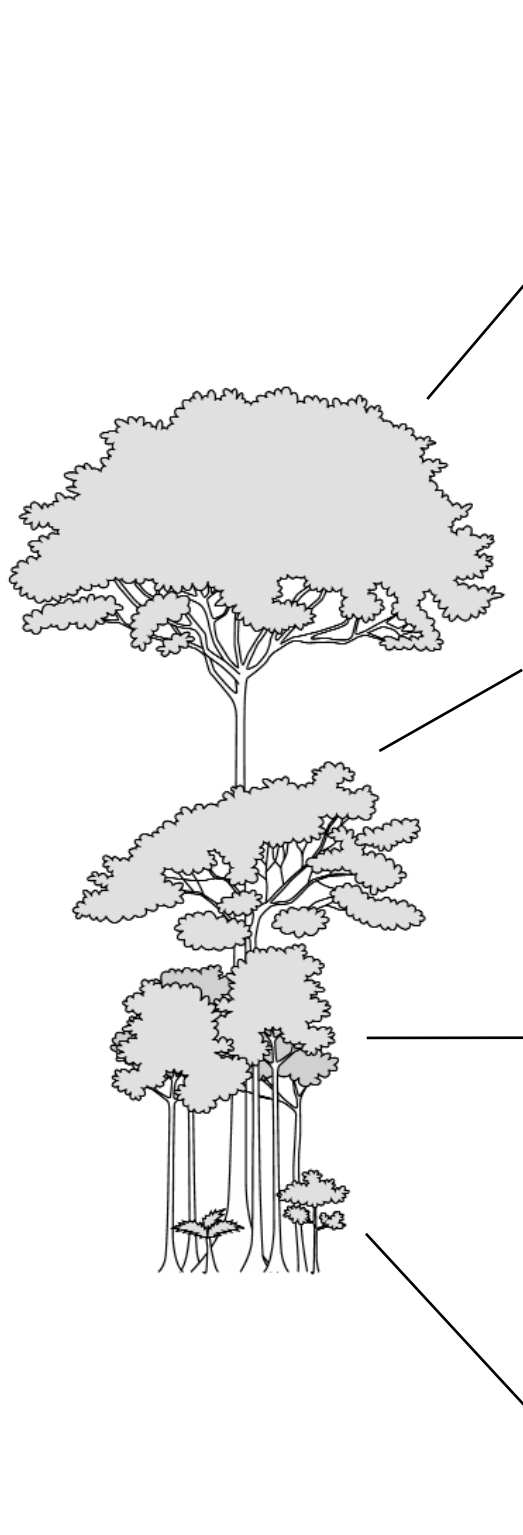
Once you figure it out, make a report. Draw a picture like the one on page 10, but make it for your area. What kind of insects, plants, and animals are native to your home? You could find this information by walking around outside. You could also ask other people. Or you could read a book, or search the Web. You'll probably be surprised by the cool things you learn about your neighbors!

Glossary

epiphyte	a plant that grows on top of another plant (p. 13)
foliage	plant leaves (p. 16)
fungus	a small living being that grows on organic material. Some examples of fungi are molds, mushrooms, and yeast. (p. 19)
peccary	a pig-like mammal that is found in the Americas (p. 17)
piranha	a South American freshwater fish that has very sharp teeth (p. 6)
prehensile	able to grab on to things (p. 14)
resident	a person (or animal) who lives in a place for a long time (p. 13)
species	a group of similar living beings. Human beings are one such group. (p. 5)
talon	a claw, particularly of a bird that hunts (p. 12)
unsuspecting	unaware of potential dangers (p. 12)
volume	the amount of space that something takes up (p. 7)

Name _____

INSTRUCTIONS: Answer the question in each large box, and fill in the remaining boxes with the requested information.



Emergent

What layer is this?

Name two animals that live in (or visit) each layer.

What layer is this?

What layer is this?

What layer is this?

Name _____

INSTRUCTIONS: Follow the instructions in each section below.

A. Adverbs

Write adverbs to describe the following verbs:

_____ fly	_____ climb	_____ jump
_____ walk	_____ hang	_____ swing

B. Adjectives

Write adjectives to describe the following nouns:

_____ tree	_____ bird	_____ nest
_____ monkey	_____ fruit	_____ flowers

C. Homophones

Use the following homophones correctly in sentences.

hear, here _____

ate, eight _____

billed, build _____

sole, soul _____

knew, new _____

Pirate Ships and Flags

A Reading A-Z Level U Leveled Reader

Word Count: 1,804

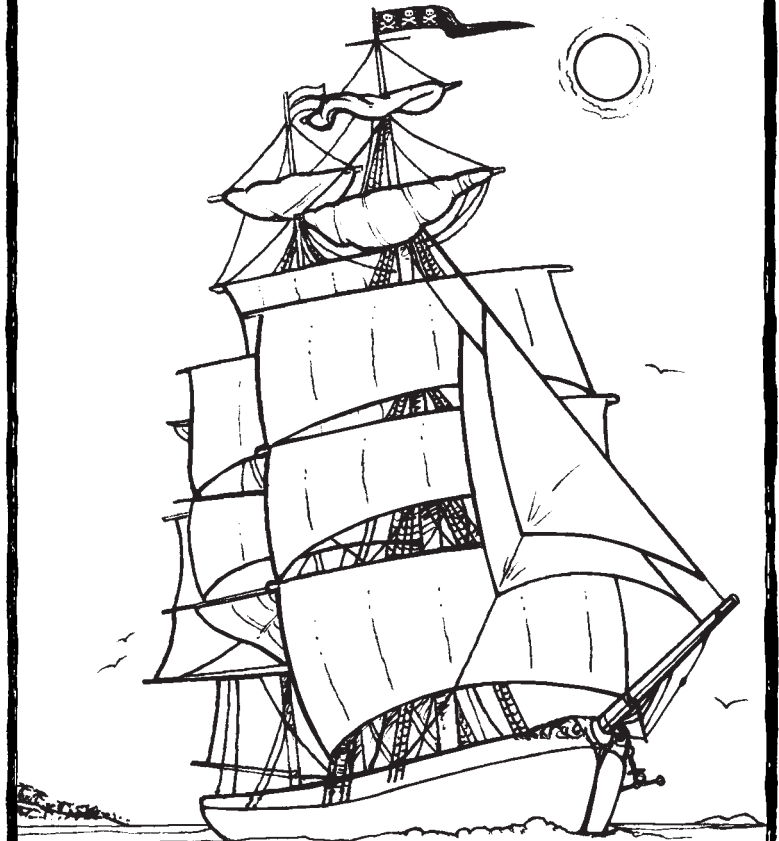


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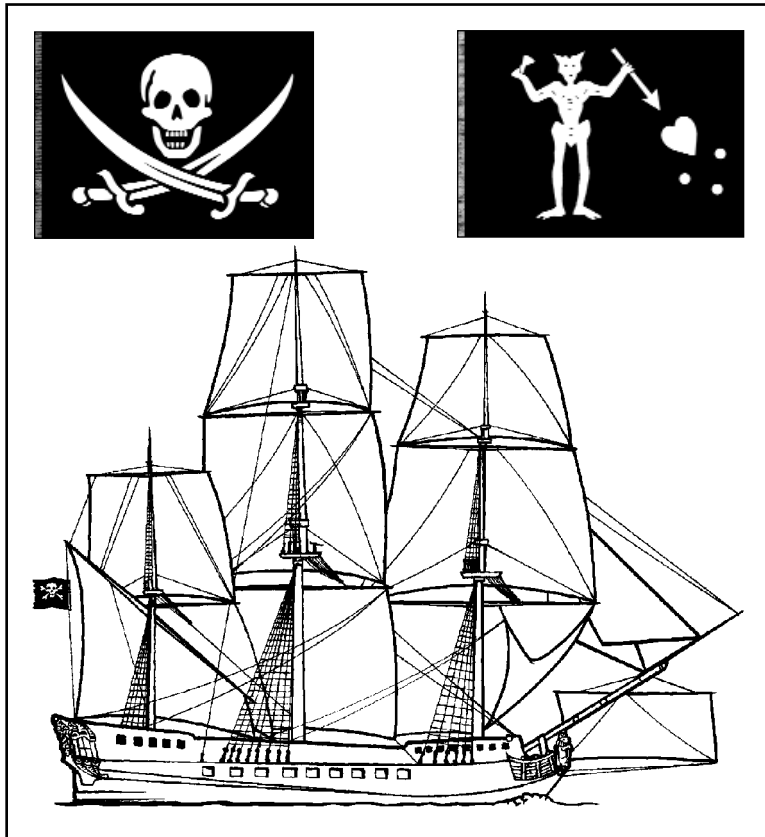
PIRATE SHIPS AND FLAGS



Written by Robert Charles
Illustrated by Paula Schricker

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Pirate Ships and Flags
Level U Leveled Reader
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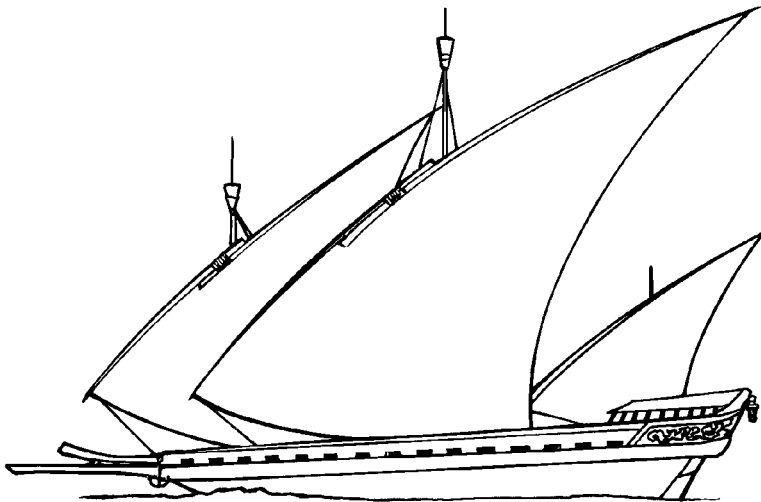
Correlation

LEVEL U

Fountas & Pinnell	Q
Reading Recovery	24
DRA	40

TABLE OF CONTENTS

Introduction	4
Greek and Roman Pirate Ships	6
Viking Pirate Ships	9
Pirate Ships of Northern Africa	11
Chinese Pirate Ships	13
Pirate Ships of the Caribbean.....	15
Pirate Flags.....	17
Life on a Pirate Ship	20
Conclusion	22
Glossary	23



A clipper

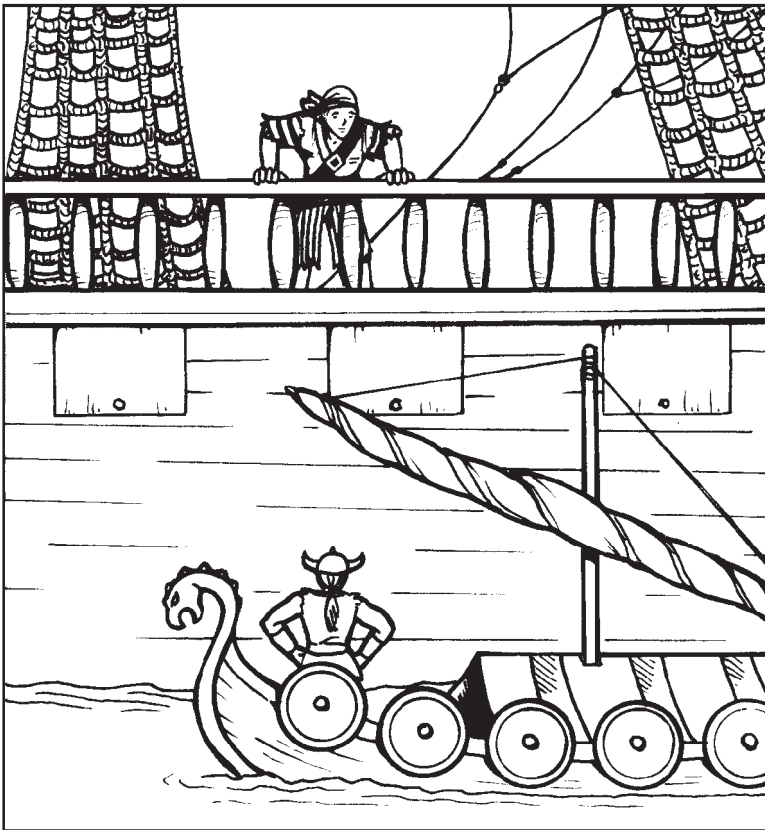
INTRODUCTION

Pirates were robbers. They did their dirty deeds at sea. They attacked ships carrying treasure. They even went ashore to attack villages. They took gold, silver, and jewels. They also took fine fabrics, spices, grain, coffee, and tea.

The success of a pirate attack often depended on the ship they used. Pirate ships came in many sizes and shapes. The type of ship used by pirates depended on the part of the world they came from. It also depended on the period of time that the pirates operated.

Early ships were not as large or as fast as most of the ships that were used in the 1700s. This was the Golden Age of piracy, and pirate ships were large and fast.

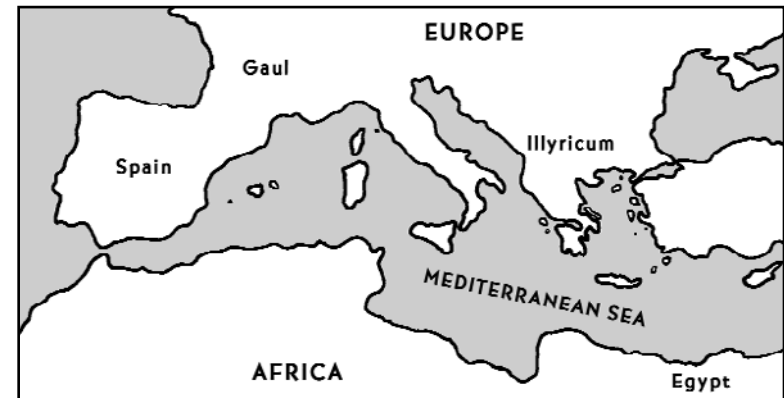
As you read, you will learn about different types of pirate ships. You will also learn about life on these ships. You will also read about pirate attacks.



To illustrate the difference in size of pirate ships, a pirate on a 1700s ship looks overboard at an 1100s Viking ship.

GREEK AND ROMAN PIRATE SHIPS

Some of the earliest pirates were from the ancient Greek and Roman empires. They did their pirating over 1,500 years ago. The sea around Greece was filled with many small islands. Ships carrying valuables sailed through the islands. They traveled close to the shore. This made it easy for the pirates who were hiding on the islands.



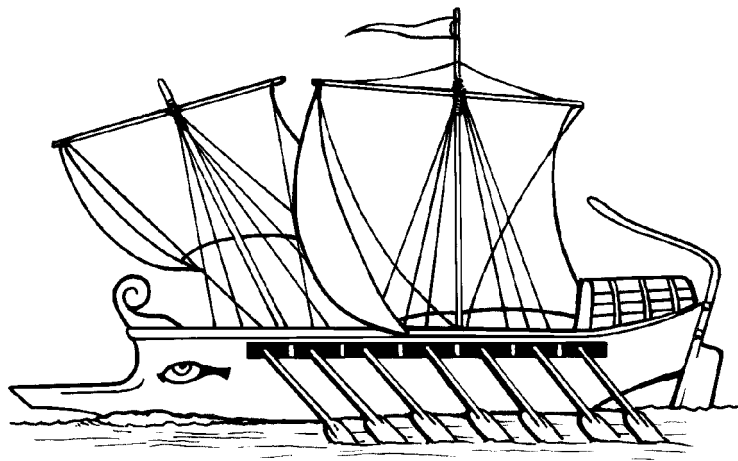
At its height, the Roman empire stretched around the entire Mediterranean Sea.

DO YOU KNOW?

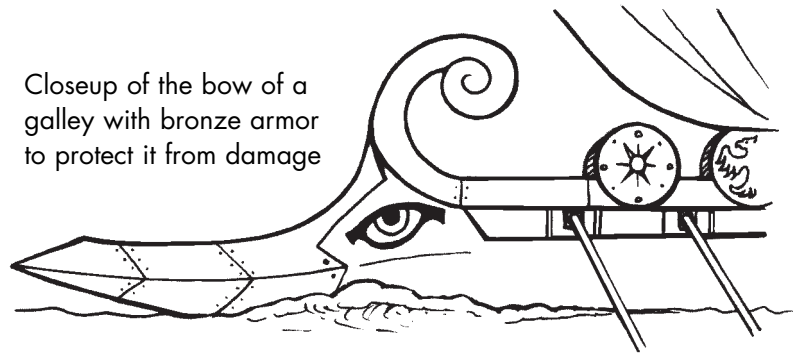
In about 75 B.C., when Julius Caesar was young, he was captured by pirates while on his way to Rhodes to study. He was held for five weeks until his ransom was paid. He later tracked down his captors and had them killed.

The Greek pirates used streamlined ships for their attacks. These ships were called **galleys**. These **sleek** ships were powered by oars. Some also had a single large sail. Depending on the size of the pirate ship, dozens of pirate crewmen rowed the ship. A galley under the power of many oars was much faster than the clumsy cargo ships that depended on wind power. A galley could quickly overtake a slower cargo ship.

Galleys were also shallow. This made them easier to steer. They could quickly change direction. It also meant that if the pirates were being chased, they could escape to shallow water. They could also go over rocks that large ships would get caught on.



A galley



These pirate ships often had sharp battering rams attached to the **bow** or front of the ship. They would ram the victim ship, trying to punch a hole in its side, or **hull**. If the ship being attacked took on water, it became even slower.

Romans were not natural seamen like the Greeks. So they built many of their ships to copy the Greeks. Roman pirates also used galleys powered by long oars. Some of these galleys had rowers at more than one level of the ship. The poor oarsmen who rowed below the deck were forced to row where it was hot and stinky.

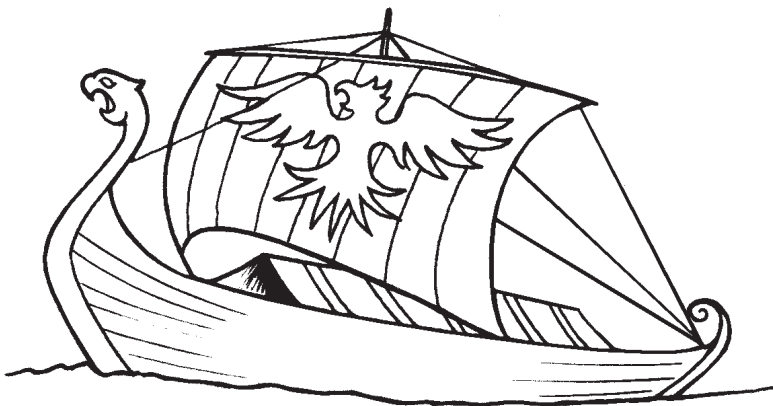
Do You Know?

Roman pirate ships often had eyes painted on both sides of the bow. The pirates claimed the eyes helped them find their victims. The idea of painting eyes on ships probably came from Egypt. Egyptians thought the eyes brought good luck.

VIKING PIRATE SHIPS

While the Greek and Roman pirates threatened ships sailing around southern Europe, the Vikings ruled the seas of northern Europe. The Viking pirates were ruthless villains of the north. They attacked ships at sea as well as villages along the coast. These bearded men of the north gained a reputation for being very fierce **barbarians**.

Vikings were expert shipbuilders. The seas of northern Europe were often very rough, unlike the smoother waters of the Mediterranean Sea. The ships used by Viking pirates had to be strong so that they would not break up in the rugged sea. Their ships were known as **longboats**.

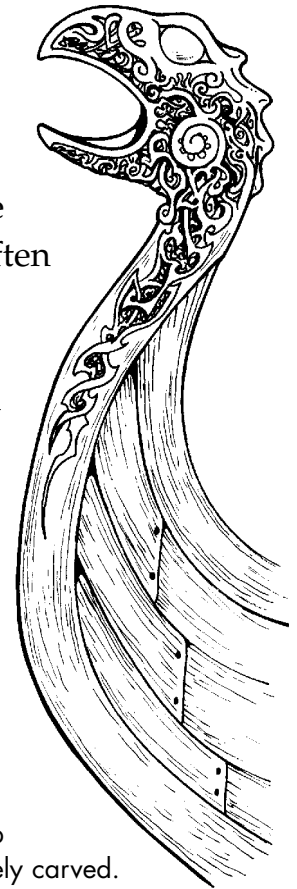


A Viking ship

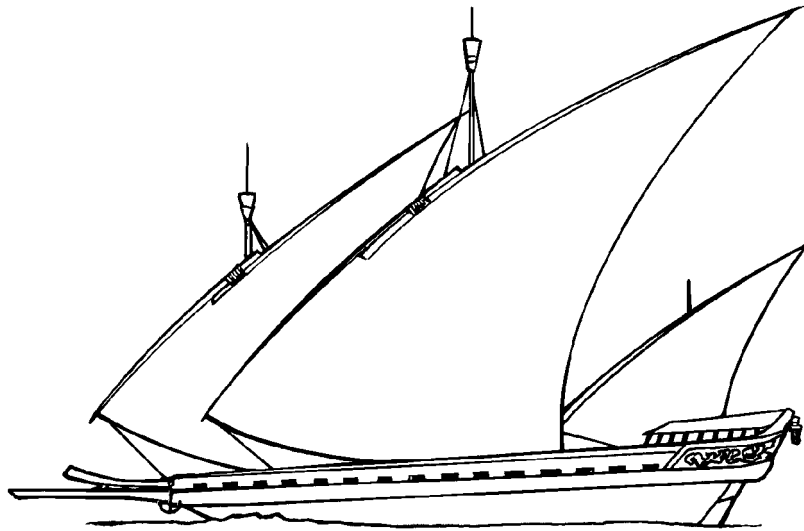
Longboats were long, as their name suggests. They were also narrow and sleek. This made them fast and easy to steer. They were powered by a large square sail when in the open sea. When near the shore or going up rivers, they were powered by oars. The longboats were shallow and could land almost anywhere. This made it easy for Viking pirates to sneak up on ships and villages and quickly attack.

Longboats were also unique for their design. The front and back of the longboat curved upward to a point. It was difficult to tell the front from the back. The point, or **pro**w, was often decorated with a dragon's head. These boats were called dragon boats. Other prows were shaped like snake heads or the heads of other figures.

Longboats could hold over 50 Viking pirates. These pirates carried spears, axes, swords, and bows and arrows to use in their attacks.



The bow of a Viking ship was sometimes elaborately carved.



A Corsair galley

PIRATE SHIPS OF NORTHERN AFRICA

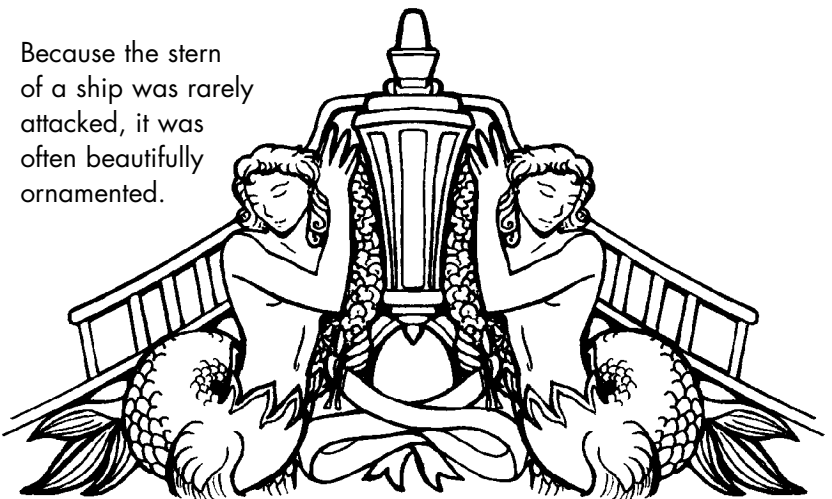
Another group of pirates did their pirating along the northern coast of Africa a little over 1,000 years ago. These pirates were known as Barbary corsairs.

Corsairs used sleek galleys much like the ones used by the Greek and Roman pirates. The oars were manned by slaves, which left the pirates free to do the fighting.

The corsairs' ships were sleek and fast. Slaves scraped and waxed the hull of their galley between trips at sea. This increased the ship's speed. The galleys were powered by both oars and sails. The oars were long and heavy. A single oar might have to be rowed by several men. A corsair galley could have two to three masts, each holding a sail of a different size.

A corsair galley often held over one hundred men. This meant that trips to sea had to be short, since the galley could not carry enough food and water for long trips.

Some corsair galleys were beautiful ships. They were often painted with gold decorations, and gold-painted human figures often extended from the back of the ship.



Because the stern of a ship was rarely attacked, it was often beautifully ornamented.

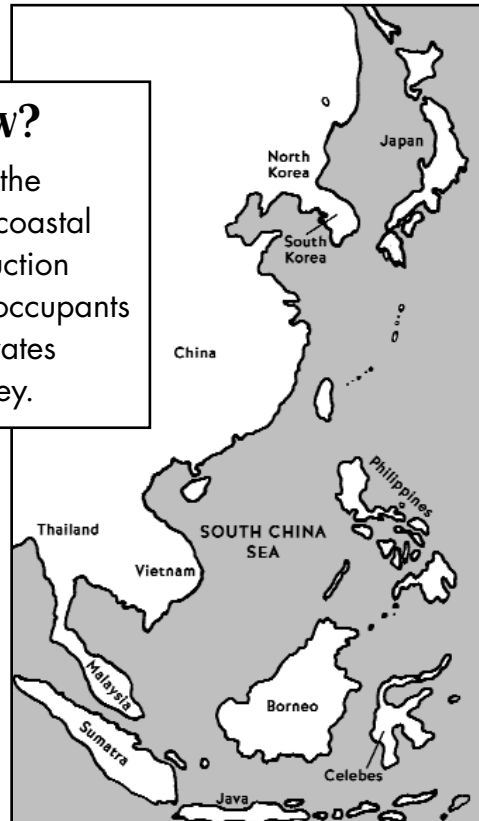
CHINESE PIRATE SHIPS

The seas and coastline of China and southeast Asia were perfect settings for pirates. Chinese pirates hid in mangrove swamps that lined the coast. Chinese pirate captains often led fleets of small pirate ships.

One pirate commander, Ching-Chi-ling, led a fleet of nearly 1,000 heavily armed ships.

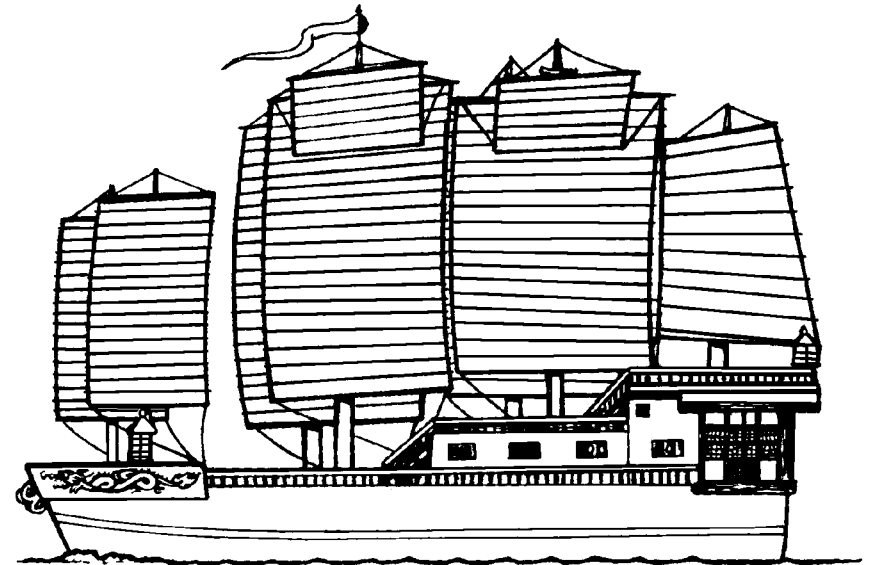
DO YOU KNOW?

Chinese pirates in the 1800s threatened coastal villages with destruction and slavery if the occupants did not pay the pirates large sums of money.



Larger Chinese pirate ships were called **junks**. These junks were often converted cargo ships. This meant that they were slower than most of the pirate ships you have been reading about. What these ships lacked in speed they made up in arms. They carried over a dozen large guns. They were such good fighting ships that the Chinese navy could not defeat them.

Pirate junks often had three **masts**. The sails were large and had four sides. They were made of silk reinforced with strips of bamboo. These ships were large enough to provide the captain with a nice place to stay. But the crew lived below in the crowded hold.



A Chinese junk



PIRATE SHIPS OF THE CARIBBEAN

Probably the pirates we know the most about are the pirates of the Caribbean Sea. The islands of the Caribbean were perfect hideouts for pirates looking to **plunder** ships carrying gold and silver. These unruly pirates attacked many Spanish ships passing through the islands.

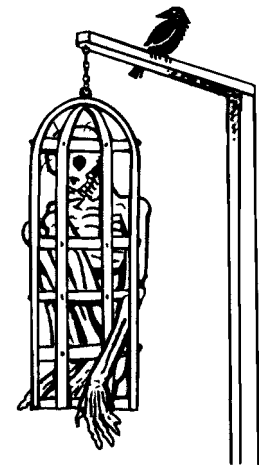
The pirates of the Caribbean did not sail the high seas. Instead, they stuck close to shore and sailed among the islands. Therefore, they did not need large ships. These pirates preferred to use **sloops** and **ketches** to attack other ships. These smaller boats were fast and easy to move around.

Ketches were equipped with two masts. A main mast rose from the center of the deck. A smaller mast rose from the back section of the deck. Ketches also had a long pointed pole extending forward from the bow. It was called a **bowsprit**. The bowsprit on some ketches was as long as the main body of the ship. Triangular sails were rigged to the bowsprit. These sails increased the ketch's speed.

The main mast held a large square mainsail. If the wind blew from behind the ship, the crew would raise the mainsail, and the wind would push the ship through the water. Sails rigged to the back mast were used to move the ketch in different directions. The ketch's **variety** of sails made it a **versatile** sailing ship.

DO YOU KNOW?

The bodies of executed pirates were placed in iron cages and hung from wooden frames where they could be easily seen. This was done to discourage others from becoming pirates.





"Calico" Jack Rackham's flag

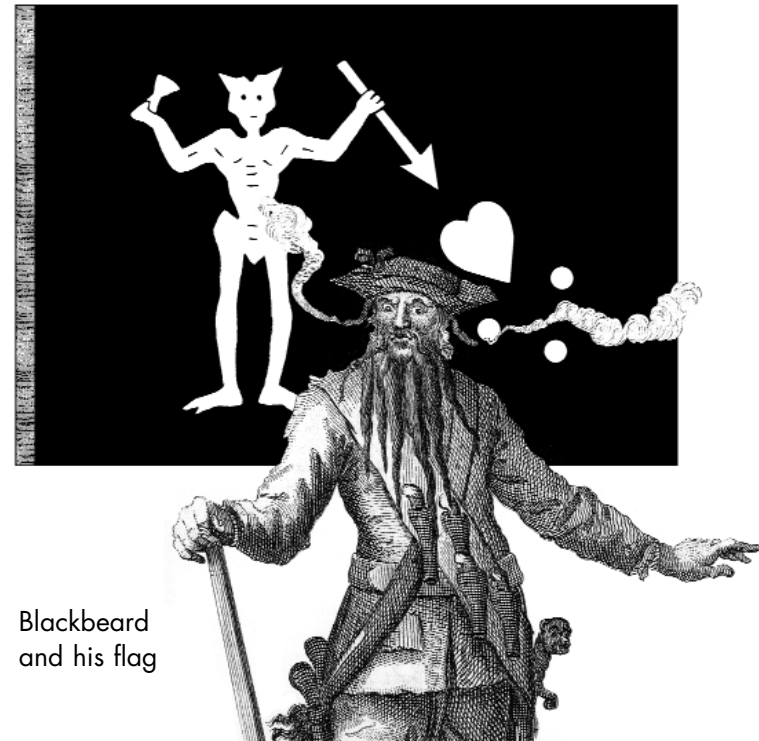
PIRATE FLAGS

Pirate ships flew flags to warn other ships that they were about to be attacked and that they should surrender. Flags were used to strike fear in the crew of ships about to be attacked. Some flags carried scarier messages than others. For example, an all-red flag signaled certain death. However, sometimes pirates were sneakier. They would sail a friendly flag first. Then when they got close to the ship they were attacking, they would raise the pirate flag.

The best-known pirate flag was the Jolly Roger. It was decorated with a skull and two crossed swords, or crossbones. It told crew members on a ship being attacked to **surrender** without a fight or face death.

In addition to skulls, bones, and swords, pirate flags were decorated with hourglasses, skeletons, and blood. The hourglass signaled that time was running out and the crew should surrender.

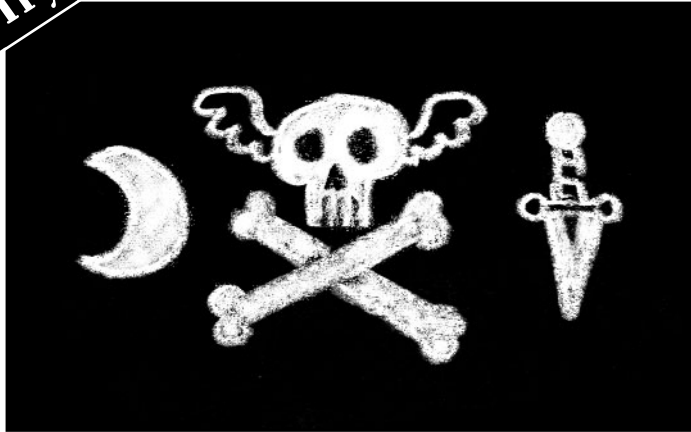
One of the most **notorious** pirates of all time was Blackbeard. He was a madman who was feared even by his crew. Blackbeard's flag was a skeleton that looked like a devil. The skeleton held a spear that pointed at a red heart. Drops of blood dripped from the heart.



Blackbeard and his flag

Try This

Make your own pirate flag!

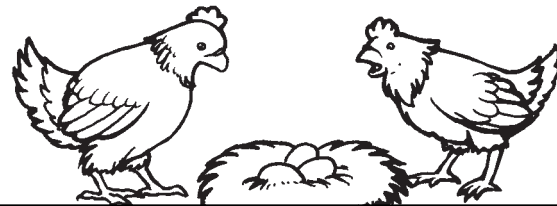


- 1 Draw your design on paper first. Use big, clearly defined shapes and symbols that can be seen from far away.
- 2 Get a large piece of colored construction paper or old fabric for the background of the flag.
- 3 Cut other colors of fabric or construction paper into the patterns and shapes you drew in your design.
- 4 Glue or paste the patterns to the background of your flag.
- 5 Finally, write an explanation of your flag's symbols and meaning.

LIFE ON A PIRATE SHIP

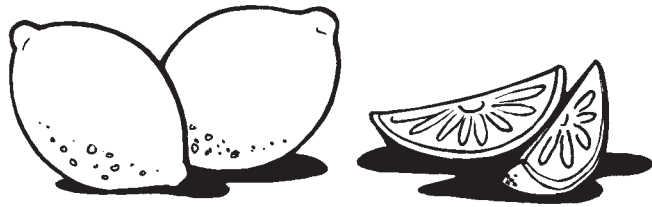
Life on a pirate ship was difficult and harsh. When not experiencing the excitement and danger of an attack, life was often boring. Much of the time spent between attacks was spent repairing sails and **riggings**. Sailing a ship also was hard work. Muscle power was all the pirates had to rely on to do the work. Sails had to be raised and lowered as conditions changed and to keep the ship moving fast. Teamwork was important.

Pirates slept below the deck in the ships hold. **Quarters** were usually cramped, with each crewman having very little space. They kept their personal property in a sea chest. They slept in hammocks. When the weather was good, pirates would often sleep on deck.



DO YOU KNOW?

Sometimes chickens were kept aboard the ship. They provided a supply of eggs and fresh meat.



Do You Know?

Fresh fruit, especially limes, were taken on long voyages to prevent diseases such as scurvy. The fruit gave sailors much-needed vitamin C.

Pirate ships usually had a population of rats. The rats chewed sails and ropes and ate food supplies. Rats were even known to chew through a ship's hull and sink a ship.

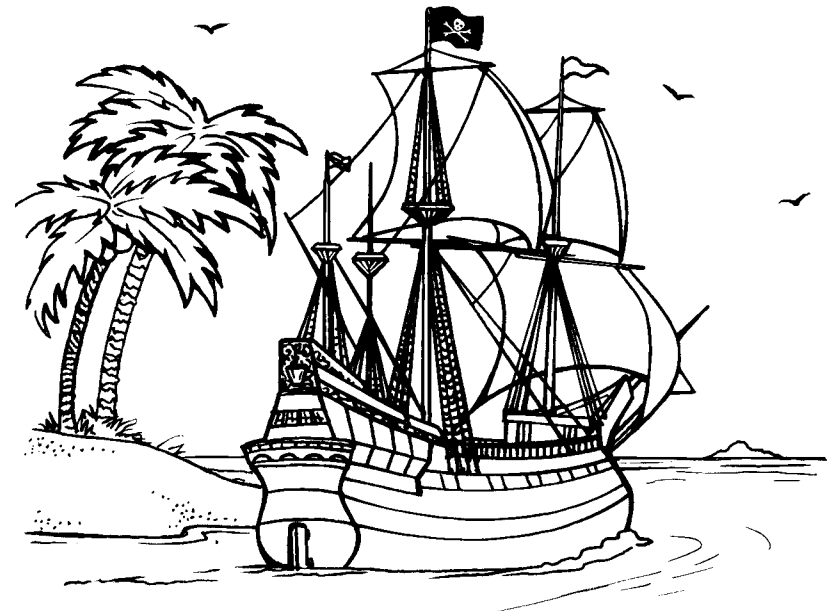
Food aboard a pirate ship was nothing to get excited about. They had very little fresh meat. When they did, it was usually turtle meat. If the fish were biting, pirates ate fresh fish. Otherwise meals consisted of dry, salted meat and dry biscuits. All of this was usually washed down with beer, wine, or water. Ships usually had very poor cooking **facilities**.

Pirates ate off of metal plates. If they were lucky, they had a fork or spoon. Otherwise they just used their fingers. Pirates were not known for their good manners.

CONCLUSION

Most pirate ships were small and fast. Early ships were powered by oars. But by the 1700s most pirate ships were powered by the wind. But even these sailing ships were sleek, fast, and easy to steer. They were shallow so they could escape their enemies and enter shallow ports.

Life aboard a pirate ship was not very pleasant. Conditions were often dirty and crowded. The work had to be done by the pirates themselves, except in earlier times when slaves did the work.



A galleon

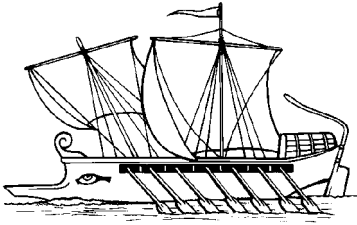
GLOSSARY

barbarians	a group of violent, uncivilized outsiders (p. 9)
bow	a ship's front end (p. 8)
bowsprit	a long, thin pole attached to the bow of some ships, which provided another anchor point for sails (p. 16)
corsairs	pirates, especially those from the Barbary Coast of Northern Africa (p. 11)
facilities	built-in places that make certain actions easier; i.e. restroom facilities and cooking facilities (p. 21)
galleys	small, shallow boats used by Greek pirates to overtake larger ships (p. 7)
hull	the main body of a ship (p. 8)
junks	large ships with three masts and advanced weaponry used by Chinese pirates (p. 14)
ketches	small two-masted ships with the first mast taller than the second, and the steering position behind the second mast (p. 15)

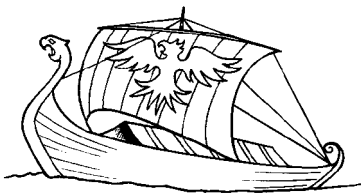
longboats	long, narrow boats with sails and/or oars used by Viking pirates (p. 9)
masts	tall, vertical poles on ships that are used to attach sails, flags, and to post lookouts (p. 14)
notorious	being famous for being dangerous (p. 18)
plunder	to steal everything of value (p. 15)
prow	a ship's front end (synonymous with bow) (p. 10)
quarters	living space, especially on a ship (p. 20)
riggings	the network of ropes holding up and controlling the mast and sails (p. 20)
sleek	smooth and lean; elegant (p. 7)
sloops	relatively small and fast single-masted ships (p. 15)
surrender	to give up; to stop fighting in order to preserve one's life (p. 17)
variety	assortment of different things that serve different purposes (p. 16)
versatile	usable in many different ways (p. 16)

Name _____

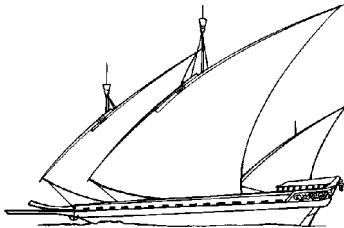
INSTRUCTIONS: Using the details from the story and in your own words, write two or three sentences that describe the differences between each of the ships pictured below.



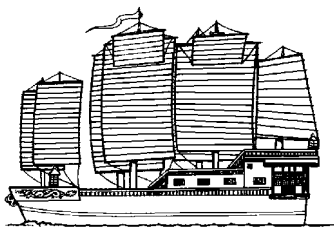
Galley — Greek Ship



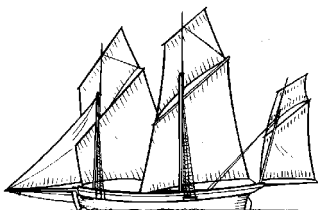
Viking Longboat



Galley — Corsair Ship



Chinese Junk



Caribbean Sloops
and Ketches

Name _____

INSTRUCTIONS: In the space below, draw a picture of your own pirate ship. Design the pirate ship with the features that you think would be the most useful. Label parts and write a paragraph that says where the pirate ship is going, who will be on it, and what will be taken. If you need to, you can refer to the book.

Don't Wake the Mummy

A Reading A-Z Level U Leveled Reader

Word Count: 2,582



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Table of Contents

Chapter One	4
Chapter Two	9
Chapter Three	11
Chapter Four	14
Chapter Five	16
Chapter Six	19
Glossary	22



Chapter One

“To speak the name of the dead is to make them live again,” the tour guide whispered **ominously**. The class giggled at what they thought to be just another staged part of the tour.

“Throughout the tomb,” he continued, “and especially when we enter the burial chamber, we must refer to the mummy as ‘The King’ or ‘Pharaoh.’ Is that understood?” The group members nodded their agreement as they quickly realized this was not another superstition. I knew the guide had been telling the truth because I had read about it on the Internet in preparation for our class trip. Now here we were, in Egypt, inside an actual pyramid, on our way down to the burial chamber to look at an actual mummy.

"Come along children. Step lively." Mrs. Crabwalk's **shrill** voice rose above the noise, and everyone **obediently** started to file out of the ritual shaft in pairs—everyone except for Simon. I found him at the back of the room trying to decipher the hieroglyphics on the wall. "Simon Montier, what would you do without me?" I teased. "Honestly, sometimes I think you actually want to get left behind." He didn't care; he was curious about everything and wasn't happy unless he had a problem to solve.

"Amy, look! I've figured out what this means," Simon said. I glanced back and checked the progress of the **queue**. Only half of the group had filed out of the room, so I figured we had a couple of minutes left. I definitely wanted to hear what Simon had found out, but I absolutely did not want to get in trouble with Mrs. Crabwalk.



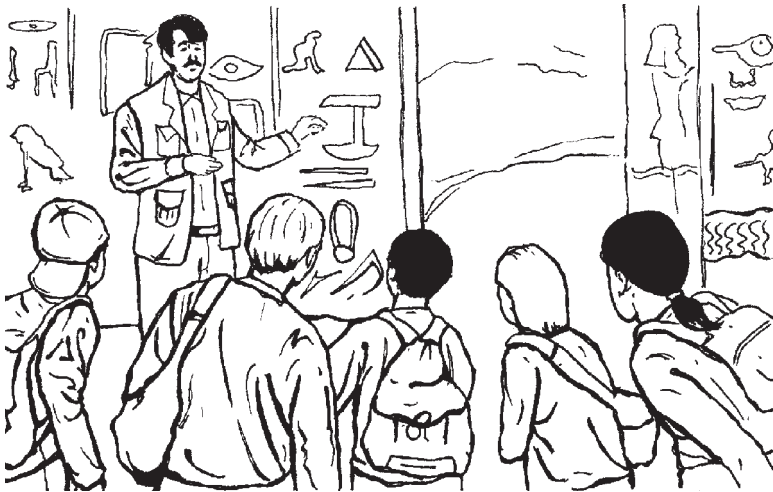
"It says here that they pulled the mummy's brains out through its nose." Simon grinned at the grossness of it all. The guide hadn't mentioned any of the details Simon was describing. I guess the guide thought it would be too scary for our fourth-grade class. I had to admit, it was pretty revolting, yet I found myself listening to Simon translate the entire **mummification** process.

"Yuck!" I wrinkled my face in disgust, turning away from the last picture on the wall just in time to see the last two students leaving the chamber. My **revulsion** was quickly replaced by my need to stay out of trouble, so I grabbed Simon by the shirt and dragged him toward the door. We waited for Mrs. Crabwalk to turn the other way, and then we successfully slipped into the back of the line.

Our classmates stomped and chattered their way up a wide flight of stairs, down a narrow corridor, and into the next chamber. Simon stopped to inspect every insect and object that crossed our paths. I had to drag him back to the line at least three times. Finally, we all crowded into a room where the walls were covered with images of the pharaoh and several gods. The guide motioned for everyone to gather around

one of the images. He launched into an explanation of the relationship between the pharaoh and his people and how the pharaoh was connected to the gods. Of course, I already knew this story, but it was a hundred times more fascinating listening to it while looking at the actual **hieroglyphics** on the walls than reading about it in school. Simon, however, did not find it as interesting as I did and had decided to translate his own story. He stayed close enough to the group, so I decided to leave him alone.

The guide finished his narrative on the life of the pharaoh and made his way to the back of the room. He paused in the doorway and called for everyone's attention. "Before us is the burial chamber where the mummy of the great king



lies." The room went completely silent. The guide had captured everyone's interest, even Simon's. "Enter if you dare!" he shouted and then disappeared into the darkness of the burial chamber. Simon and I agreed it was all very theatrical, but pretty cool. We joined the line and walked, single file, into the tomb.

Exclamations of surprise echoed around the chamber as the red **sarcophagus** came into our view. This room was much smaller than the rest, and we all crowded around, smashing elbows to get a closer view as the guide slowly raised the lid to reveal the full-sized mummy inside. Shrieks arose from a group of girls who scooted to the back, **vacating** prime space in front. Simon and I squeezed our way toward the sarcophagus and looked in awe at the mummy.

A group of boys eagerly pushed themselves between us. I held my spot as long as I could, but there was just too much shoving. I finally managed to squeeze my way out of the tightly packed mass of bodies and went looking for Simon. He was sitting in the corner reading an ancient-looking book filled with hundreds of illustrations. I peered over his shoulder at page after page of strange pictures of pharaohs in boats on journeys to mysterious places.



Chapter Two

"Where are they going?" I asked. "I'm working on it," Simon mumbled. "But I think they're traveling in the underworld." I glanced over my shoulder to check on the others and saw they had already left the tomb. I jumped up in a panic and ran to the next room. "Everyone's gone, Simon!" I shouted from there. I ran back to the burial chamber to get him. "Simon, come on! We're going to get in trouble with Mrs. Crabwalk."

He didn't even look at me. Impatiently, I stomped over and grabbed his arm.

"I figured it out!" he shouted. "The picture relates the journey that King Amenhotep II took in some sort of solar-powered boat on his way to the sun god."

I dropped his arm and felt a look of horror spread over my face.

Simon was immediately apologetic. "I'm sorry, Amy. I didn't mean to keep us here so long. Don't worry. Maybe Mrs. Crabwalk won't notice our absence if we hurry."

"You said his name," I whispered.

"Whose name? Do you mean King Amenhotep?"

"Shhhh. Stop saying it. Don't you know that if you speak the name of the dead, you make them live again?"

His eyes widened with **comprehension**. "Oh, no—I forgot." He slapped his forehead with the palm of his hand. "How could I be so stupid? I read about that, and it even mentions it here in this book," Simon said as he fumbled with the book. It flipped out of his hands and landed with a thud.

We both looked at the book lying on the dirt floor near the closed sarcophagus in front of us. For an entire minute, we didn't breathe or blink, but nothing happened. "I guess it really is just a superstition," I said with a sigh of relief. We headed for the door.



Chapter Three

Then, a low, scraping noise stopped us in our tracks. We turned back and watched in horror as the mummy slowly opened the lid of the red sarcophagus.

"This can't be happening," we both squeaked at the same time. I felt as if my feet had grown roots and fastened me to the ground. "Oh, we're going to get in so much trouble," I moaned. "How are we going to solve this problem?"

"The book!" Simon exclaimed and ran back into the room to get it.

The sarcophagus was now completely open, and the mummy slowly sat up. He was directly between Simon and the doorway. Simon was trapped.

"Over here!" I yelled, distracting the mummy enough for Simon to escape. He grabbed the book and ran right by the mummy, pulling me out the door after him.

We sped down the stairs and hid behind one of the pillars at the far end of the next room. My heart was beating so fast, I could barely speak. "What...are...we...going...to...do...now?" I gasped.

"Don't worry, I'll figure it out. Just keep an eye out for the mummy while I search this book for answers," he said. So I crouched down and peeked out from behind the pillar, waiting for the mummy to find us. "I think I found something," he whispered. But it was too late. The mummy had entered the room and was coming down the stairs toward us.

"Save it for later. We have to get out of here now," I insisted, yanking Simon up by the back of his collar and rushing him out of the chamber into the long narrow corridor.

"I don't think he saw us," I whispered. But I had spoken too soon. The mummy had entered the corridor and was heading toward us. We made a dash for the next chamber and hid behind another pillar in the back of the room. I resumed guard duty and kept an eye on the door.

Simon quickly flipped through the pages of the book, frantically trying to locate the answers he had just found. "DARN IT!" he shouted. "There's a page missing from this book. This picture only tells us what happens *after* they make him a mummy. But I know I've seen the picture we need somewhere."



Chapter Four

Simon mumbled and started to pace about the room. I couldn't believe it; if Simon wasn't able to solve this problem, we were really going to be in trouble. I started to panic. "Why did you have to be staring at those pictures on that wall instead of listening to the guide's warning?" I grilled Simon. "If you had been paying attention, we wouldn't be in this mess."

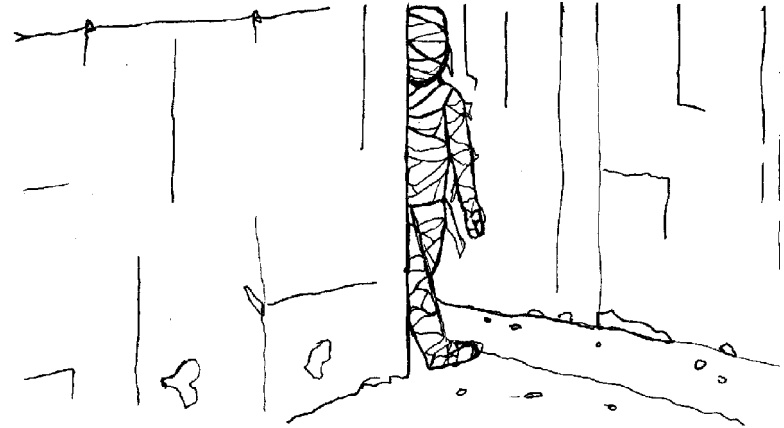
Shouting at Simon didn't make me feel any better, and I realized I also had forgotten to tell Simon about the guide's warning. I was just about to apologize when he jumped up and hugged me.

"That's it! The pictures in the ritual shaft. That's where I saw it. Thanks, Amy. That was good thinking." He ran ahead, leaving me all alone in the room with the mummy fast approaching.

"Wait for me!" I screamed, running after him.

Simon was already hard at work when I burst into the room. "Quick, Amy, write this down." I swung my backpack to the dirt floor and pulled out a notebook and pen. I wrote rapidly as he dictated the words from the wall. We were finished in no time.

"What's the plan, Simon?" I turned my head first one way and then the other as I tried to watch the doorway and Simon at the same time.



Chapter Five

"First we have to lure the mummy back into the burial chamber," Simon said. "Once he's there, I'll repeat the chant to make him go back to sleep." It sounded simple enough, and I was beginning to feel confident that everything would work out . . . until Simon added, "Of course, I sure hope he decides to crawl back into the sarcophagus *before* he falls asleep. Otherwise, we're going to have to pick him up and put him there." My confidence faded, partly because I didn't like the thought of having to touch the mummy and partly because the mummy chose that moment to enter the room. And, boy, was he cranky. I guess I couldn't blame him. If I had been sleeping for over 3,000 years and someone suddenly woke me up, I'd be cranky, too.

"He's back," I whispered urgently, cramming my notebook into my pack as we got ready to **initiate** our plan. We waited until the mummy had descended the stairs before sprinting by him, back up the stairs, and into the corridor. I looked over my shoulder and saw the mummy coming after us.

"It worked. He's following us, and he's moving much faster. I guess he's wide awake now," Simon said. We raced down the stairs into the burial chamber and ducked into the annex room off to the left. Simon pulled the notebook from my pack and found the only page with writing. We waited and watched as the mummy grunted and stomped around the chamber, trying to find us. I signaled Simon to begin the chant.



"King of kings
Pharaoh of the land
Lie back down to rest
In the burning desert sand."

Simon recited the chant from our hiding place. We watched closely to see if it was taking effect. The mummy took a step in our direction. "Quick. Read the second verse," I said urgently, and Simon resumed the chant.

"In a red sarcophagus you were kept,
Where you spent 3,000 years in slumber.
Return now to the place you slept
And travel back to your time of wonder."

The mummy stopped and rubbed his eyes. I had to sit on my hands to stop myself from clapping as he turned and headed toward the sarcophagus. The chant was working; the mummy climbed back into his sarcophagus and lay back down. We waited a full minute until we were satisfied he was asleep, and then we tiptoed over, slowly closed the lid, and ran out of the room.

Once we reached the next room, we grinned **triumphantly** and gave each other a flying high five.



Chapter Six

We had solved one problem, but we still had two more to go. First, we had to find our way out of the pyramid, and second, we had to sneak back into the group before Mrs. Crabwalk noticed we were missing. The map in the guidebook quickly led us through the chambers, down the corridors, and up the stairs into the hot desert air. But slipping back into the group **undetected** was not going to be as easy. We could see that Mrs. Crabwalk had already counted half of the students in the line.

Simon and I ran behind the tour bus, hid in a herd of camels, and finally slipped into the back of the line behind huge Harry and gigantic George. We were just in time; two minutes later she counted us as numbers forty-nine and fifty, the last two in the head count. "Okay, everyone's here. Let's get on the bus!" Mrs. Crabwalk shouted, and we all marched forward, two by two.

Off to our left, we saw another tour group heading down into the pyramid. "To speak the name of the dead is to make them live again," we heard the tour guide whisper ominously. I noticed two kids at the back of the group weren't paying attention to the guide and wondered if they would soon be experiencing an adventure similar to ours.

Simon and I sat together at the back of the bus reflecting on our **escapade**. We knew all of the kids would be amazed at what we had experienced today. We knew we would become the most popular kids at school once everyone heard how brave and smart we were. But we also knew it would have to remain our little secret if we wanted to stay out of trouble with Mrs. Crabwalk.

The bus finally pulled away, heading off to the next stop on our tour. Simon and I were so exhausted that we promptly fell asleep. We did not hear the excited chatter of the forty-eight other schoolchildren on the bus. We did not hear the tour guide's preview of the upcoming tour, and we definitely did not hear his warning not to look directly into the eyes of the statue of **Anubis**. We continued to sleep peacefully as the bus carried us closer and closer to our next adventure.



Glossary

Anubis	the Egyptian jackal-headed god who was believed to lead the dead into the underworld (p. 21)
comprehension	understanding (p. 10)
escapade	risky adventure or prank (p. 20)
hieroglyphics	ancient Egyptian picture writing, using symbols for syllables (p. 7)
initiate	to begin or start (p. 17)
mummification	the process of making a mummy (p. 6)
obediently	obeying authority (p. 5)
ominously	with a sense of threat or doom (p. 4)
queue	a line of people waiting (p. 5)
revulsion	disgust and loathing (p. 6)
sarcophagus	a stone coffin (p. 8)
shrill	a sharp, unpleasant sound (p. 5)
triumphantly	joyous at succeeding (p. 18)
undetected	without being noticed (p. 19)
vacating	leaving; leaving open (p. 8)

Name _____

INSTRUCTIONS: In the table below, write the problems faced by each character and the solution to each problem.

Amy	Problem One	Problem Two	Problem Three
	Solution One	Solution Two	Solution Three
Simon			
	Solution One	Solution Two	Solution Three

Name _____

INSTRUCTIONS: Underline the action verbs and circle the adverbs in the following sentences. Then come up with three sentences containing action verbs and adverbs on your own.

1. The mummy slowly opened the lid of the red sarcophagus.
2. We continued to sleep peacefully as the bus carried us closer and closer to our next adventure.
3. Simon quickly flipped through the pages of the book,
frantically trying to locate the answers he had just found.
4. I wrote rapidly as he dictated the words from the wall.
5. Simon and I were so exhausted that we promptly fell asleep.



DON'T WAKE THE MUMMY • LEVEL U • 2

Sentences

1. _____

2. _____

3. _____

SKILL: VERBS AND ADVERBS

The Inuit: Northern Living

A Reading A-Z Level U Leveled Reader

Word Count: 1,834



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The Inuit: Northern Living



Written by David Meissner

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The Inuit: Northern Living



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LEVEL U	
Fountas & Pinnell	Q
Reading Recovery	24
DRA	40

Table of Contents

The Frozen North	4
Staying Warm	8
Venturing Out for Food	11
Work and Play	14
The Inuit Today	16
Explore More	19
Glossary	20

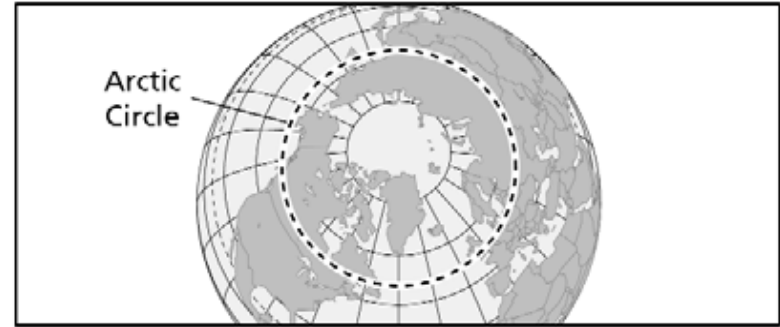
Inuit Words in English

Many Inuit spoke a language called Inuktitut. Some of the words they used are now words that we use in English.

igloo: a dome-shaped house built from blocks of snow

kayak: a light and narrow boat, like a canoe but with a covered deck

parka: a warm, hooded jacket



The Arctic is the circular area around the North Pole.

The Frozen North

There is a place on Earth where it is always cold. The ground is frozen and the land is flat. For much of the year, it is covered in a white blanket of snow.

This land is so far north that during the winter, the sun doesn't come above the horizon. The land remains dark twenty-four hours a day. But during the summer, the sun is always above the horizon. It is light outside twenty-four hours a day. That's why this place, the Arctic, is sometimes called the "Land of the Midnight Sun."

If you visit the Arctic region, you'll feel how cold it is. The temperature on an average winter day is about -34° Celsius (-30° F)! Each year, between 38 and 229 centimeters (15–90 in.) of snow fall. For many months, the Arctic's rivers, lakes, and seas freeze over. Brrr!

So if it's that cold and snowy, how can anything survive in the Arctic? The land is mostly barren **tundra** where even trees cannot grow. But some plants can take root in the far north. These are low-growing mosses, shrubs, and tiny flowering plants.

Animals have also found ways to live in the Arctic. Salmon, lake trout, and Arctic cod are fish that swim in the cold waters. Whales, seals, walruses, and polar bears live in and around the sea. Layers of fat beneath their skin serves as warm **insulation**. Wolves, foxes, and **caribou** roam the tundra. Their thick coats of fur help keep them warm. In the summertime, ducks and geese **migrate** to the Arctic to build nests and raise their young.



Caribou are a type of wild reindeer that live in North America.

So if plants and animals can survive in the far north, what about people? How would you stay warm during the cold, dark winters? How would you stay protected from the icy winds and snowstorms? How would you find food?

People have lived in and near the Arctic for thousands of years. Before there were stores, fancy jackets, or electricity, these people survived in the frozen north. They built houses from driftwood, earth, whalebones, and snow. They burned whale fat to heat their homes. And they wore animal skins and fur to brave the harsh

cold. The hearty people of the far north of North America used to be commonly known as the Eskimo, but we now know them by their preferred name, the Inuit (IN-yoo-it).



An Inuit woman

The Inuit are Native Americans. This means that their **ancestors** lived in North America since long before Europeans came to the Americas. Over time, the Inuit spread out to live in many different areas. Some of them lived just south of the Arctic where there were trees. There, they could build houses out of wood. But many Inuit lived far to the north, where there were no trees. They built houses of whale bones, hides, earth, and they sometimes built shelters out of hard-packed snow.

This Leveled Reader is about the traditional way the Inuit lived. It does not describe how every Inuit person lived, but gives an overview of how many of them lived for many years. You will read about igloos, dogsleds, ice fishing, and more. You will even find out what games the Inuit played on cold winter days. And in the last chapter, you will read about the Inuit who still live in the far north today.

Many People, Many Names

For many years, all northern Native Americans were called "Eskimo." But many tribes do not like this name because it was given to them by other tribes, some of whom were their enemies. Eskimo means "eater of raw meat." Some Alaskan tribes still call themselves Eskimo, but most northern people prefer the general term "Inuit." Some people prefer their specific tribal name, rather than a general name. And tribes in Siberia are not called Inuit. They have their own names.

Staying Warm

The Inuit knew how to stay warm in freezing conditions. For clothing, they wore the skins of Arctic animals. Inuit women cleaned these skins and sewed them into pants, socks, boots, and gloves. The most important article of clothing was the **parka**, which was a thick, hooded jacket.

Caribou skin was a popular material because it was lightweight, yet warm. When there wasn't caribou skin, the Inuit used skins from foxes, seals, and polar bears. They decorated their clothing with beads and carvings.

Some Inuit used goggles to protect their eyes from "snow blindness," or eye damage from the harsh sunlight reflecting off the white snow and ice. They carved these goggles out of wood and bone. Then they cut small slits to see through. These goggles worked like sunglasses.



Inuit mothers carried young children in the warm hoods of their caribou parkas.



Inuit sod homes were often insulated with seal or caribou skins.

Inuit houses were an essential part of staying warm. The Inuit used the best building materials they could find in their environment. Some Inuit were lucky enough to have driftwood, rocks, and **sod**. Caribou skins helped to insulate the walls. To heat and light the insides of their homes, the Inuit burned oil lamps. This oil came from melted animal fat, usually from seals, walruses, or whales. The lamps' wicks were made of moss and grass.

When the Inuit could not find wood, rocks, or sod during the long and snowy winter, they used snow and ice to build houses. People today call these snow houses **igloos**. Most people are fascinated by igloos. Not many of us can imagine living in a house built just from blocks of ice and snow. Wouldn't it be like living in a freezer? And wouldn't an igloo melt from the heat inside?

Some Inuit lived in igloos all winter long. These igloos were so tall that adults could stand up inside them. People slept, ate, and gathered in the igloo's main room. Many igloos had side rooms for storage. And sometimes underground passageways connected neighboring igloos.

The weather outside was so cold that igloos did not melt in the winter. But on the inside, igloos could be quite warm. Long entrance tunnels (just big enough to crawl through) kept out the wind and the cold. Oil lamps, cooking fires, and body heat warmed up the main room. Adults and kids slept on snow platforms covered with animal skin. Some igloos had "windows" made from clear lake ice. Caribou or seal skins lined the inside walls and kept the snow and ice from melting by trapping the heat inside.



Building an igloo: The Inuit cut out blocks of hard snow with a long knife. Then they stacked the blocks in a circle that spiraled to close at the top.

Venturing Out for Food

The Inuit developed creative ways of traveling. In the winter, teams of dogs pulled sleds through the snow. The sleds rested on skis made from wood and whalebone. In the summer, the Inuit walked over land to gather berries, seaweed, bird eggs, and wild vegetables.



Winter travel by dogsled

When the winter ice thawed, the Inuit also traveled by boat. A common boat for one or two people was called a **kayak** (KY-ak). Kayaks were like narrow canoes with covered tops. Paddlers sat in small openings. They attached waterproof jackets made of seal intestine around the edges of the openings to prevent water from getting inside. Kayaks were made so well-balanced that if they tipped, paddlers could easily roll over until they were right-side-up again.



Summer travel by kayak

The frozen tundra ground was not good for growing crops like corn, beans, or wheat. There were no stores to buy goods. Therefore, the Inuit had to travel by foot, sled, and boat to find food. They found most of their food by hunting and fishing.



The Inuit cut holes in the ice to catch fish in the cold water below.

Sometimes the Inuit hunted on land, and other times they hunted on the sea. Seals and caribou were their primary targets. Hunters used harpoons, darts tipped with poison, and bows and arrows. They speared whales, caught foxes in traps, and fished through holes in the ice.

But the **resourceful** Inuit didn't kill animals just for food. They used all parts of the animals to make tools, weapons, clothing, and shelter. For example, when the Inuit killed a whale, they first ate its meat. Then they melted the whale fat into oil to heat and light their homes. Finally, the Inuit carved knives and tools out of whalebone.

INUIT RESOURCE MENU		
Animal	Food	Other Uses
Whale	Whale meat	- fat for light, heat, and cooking - bones for knives
Seal	Seal meat	- skins for boots - intestines to waterproof kayaks
Caribou	Caribou meat	- skins for warm parkas - skins to sleep on
Walrus	Walrus meat	- skins for blankets - ivory tusks for carvings

Work and Play

Inuit men spent much of their time hunting, fishing, and making tools. Women often cooked, skinned animals, and sewed skins into clothing. The kids helped out with these chores until they were old enough to do them alone. There was no such thing as “school” for kids.

The Inuit enjoyed playing games and using their imaginations. Harsh winter storms could keep them inside for days at a time. So people told stories, sang songs, danced, and played drums made of animal skin. Sometimes they even wrestled and played tug-of-war.



Inuit boys play a traditional tug-of-war game.



The scene depicting a game of blanket toss was carved on a walrus tusk by northern Siberian people, who share many traditions with the Inuit.

Kids played with dolls, bows and arrows, and leather balls. They also decorated pins, combs, and goggles with carvings that looked like animals. Fathers often made “story knives” for their daughters. Girls used these story knives to draw pictures in the snow and dirt. They sat in circles with friends and made up stories based on the pictures.

Surely one of the favorite games for kids was the “blanket toss.” In this game, one person lay on a blanket made from walrus hides. Then all at once, everybody pulled the blanket tight. This was like a trampoline that sent people flying into the air! Sometimes they landed on their feet, and other times they did flips.

The Inuit Today

In the last three sections, you read about traditional Inuit ways of living. This is how many of them lived for thousands of years. Yet over the last few hundred years, things have changed. Today there are airports, TVs, and computers in the Arctic.

Now the Inuit are trying to find a balance between the modern world and traditional ways. Many Inuit prefer houses with electricity instead of dark igloos. But modern houses cost money. And to make money, Inuit people have to find jobs. This means that many Inuit spend their



days at jobs other than hunting and fishing. There are also fewer wild animals than before. This makes it harder to hunt.

The Inuit still eat seal, caribou, and whale meat, but they also buy food at the store. They pay money for things like fruits, vegetables, and potato chips.

Today, land in the frozen north is divided between different countries. The Inuit live in the northern parts of Canada, Greenland, Russia, and the United States. In 1999 Canada made a territory for the Inuit called Nunavut. Nunavut means “Our Land.” Its official languages are Inuktitut, English, and French.

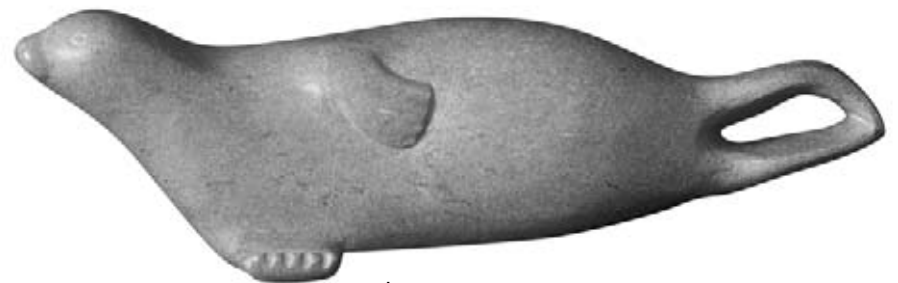
Now there are also schools in the Arctic. Children spend their days reading and writing instead of fishing and sewing. Inuit elders sometimes visit schools to teach the children Inuit traditions. They help students carve wood, sew animal skins, and tell stories. The elders want kids to remember how their ancestors lived for thousands of years.



Today over 100,000 Inuit people live in the northern parts of four different countries.

If you visited the far north today, you would need to bundle up. Maybe you’d wear a warm jacket, or two or three. If you went in the wintertime, it would be dark in the middle of the day. It would be freezing cold for days and weeks and months. A visit to the Arctic might make you wonder how people can survive in such a harsh environment.

During your visit, you would meet Inuit people. You would see how they have blended traditional ways with modern living. For example, you might see an Inuit man wearing blue jeans and a caribou skin parka. You might ride on a sled that is pulled by a snowmobile instead of dogs. Or you might see seal hunters wearing sunglasses instead of wooden goggles. And before going home, you might buy a piece of Inuit art, such as a little animal carved out of stone. It would be a souvenir to help you remember your visit to the far north.



Inuit carving

Explore More

❶ At the Library

Ask your librarian where you can find books about the Inuit and the Arctic.

❷ On the Web

- A. In the address window, type: *www.google.com*
- B. Then type: *Inuit*. Click on "Google Search."
- C. Read the colored links. Click on one that looks interesting.
- D. When you want to explore other links, click the back arrow on the top left.
- E. Or try some different searches: *Eskimo, Arctic, Nunavut, tundra*.

❸ Try Inuit Storytelling!

Whether it's sitting around a fire or talking on the bus, people have always loved to tell stories. The Inuit used to make up stories from the pictures they drew in the dirt and snow.

Try Inuit storytelling with your friends! All you need is a stick. Sit in a circle and use the stick to draw pictures in the dirt or snow. Next, make up a story about the pictures. Then hand the stick to the next person. He or she can add on to your story or make up a new one. If you let your imagination run wild, you'll probably come up with some pretty interesting (and funny) stories!

Glossary

ancestor	a relative who lived a long time ago (p. 7)
caribou	a large North American deer with wide antlers, closely related to the reindeer (p. 5)
igloo	a dome-shaped house built from blocks of snow (p. 9)
insulation	material that holds in heat, preventing warmth from escaping or cold from entering (p. 5)
kayak	a light and narrow boat, like a canoe but with a covered deck (p. 11)
migrate	to move to different regions depending on the season (p. 5)
parka	a warm, hooded jacket (p. 8)
resourceful	able to find clever ways to overcome difficulties (p. 13)
sod	the top layer of the soil, held together in a mat by the roots of grasses (p. 9)
tundra	flat, treeless Arctic region where the ground is always frozen (p. 5)

Name _____

INSTRUCTIONS: Read *The Inuit: Northern Living*. After reading the book, write down the meaning and significance of each word in the chart below.

Words	Meaning	Significance in Inuit Life
caribou		
insulation		
kayak		
migrate		
sod		

Name _____

INSTRUCTIONS: Fill out the chart below with ten adjectives from the text of *The Inuit: Northern Living*. Next, fill out the chart with the noun described by the adjective, and another adjective that is a synonym of the first adjective.

Adjective	Noun Described	Synonym Adjective

Robin Hood Wins the Sheriff's Golden Arrow

A Reading A-Z Level U Leveled Reader

Word Count: 1,762



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Robin Hood Wins the Sheriff's Golden Arrow



An English Folktale Adapted by Karina Barrentine
Illustrated by David Cockcroft

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Robin Hood Wins the Sheriff's Golden Arrow

This story is an English folktale adapted for Reading A-Z by
Karina Barrentine from an original retelling
by Bertha E. Bush published in 1912.



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DRA	40



Table of Contents

Introduction	4
The Sheriff of Nottingham	7
The Archery Festival.....	10
The Message.....	15
Glossary	16



Introduction

Robin Hood and his band of Merry Men lived a rugged, outdoor life deep inside Sherwood Forest. While such conditions could be difficult at times, the men found it pleasant to live among the trees, birds, and other animals of their realm. They had built sturdy shelters of logs and bark as protection from the cold and rain, and they didn't mind the lack of soft beds or fine chairs and tables. When it wasn't raining, they slept on deerskins, out under the stars. For their meals, the hearty band cooked over a roaring fire and ate sitting on the ground or on fallen logs.



Robin Hood's followers numbered more than one hundred, and all were considered to be hunted outlaws by the ruling lords of the land. While it was true that they broke the unjust laws that had been placed upon the people, they knew that they were in the right. Each man in his band was devoted to Robin Hood and his cause, and obeyed his every word. Robin needed only to lift his horn to his lips and play a note, and the men would appear, ready for a new task or adventure. They were strong and determined, and they were the best **archers**, wrestlers, and swordsmen in all of England. But every one of them knew that Robin Hood was the best archer in the land.

Times were bad in England, for the French had conquered the country and had ruled it harshly for many years. The English monarch, King Richard, spent many years at war far away, and his absence allowed the lords to rule the land to their own benefit. The king knew nothing about what was happening to his people while he was away. These **cruel** (KROO-uhl) lords took full advantage of the situation and became rich by overtaxing the poor, sometimes taking their farms and everything a family owned. They also were in league with **corrupt** churchmen, who misused the trust and faith of the common people.

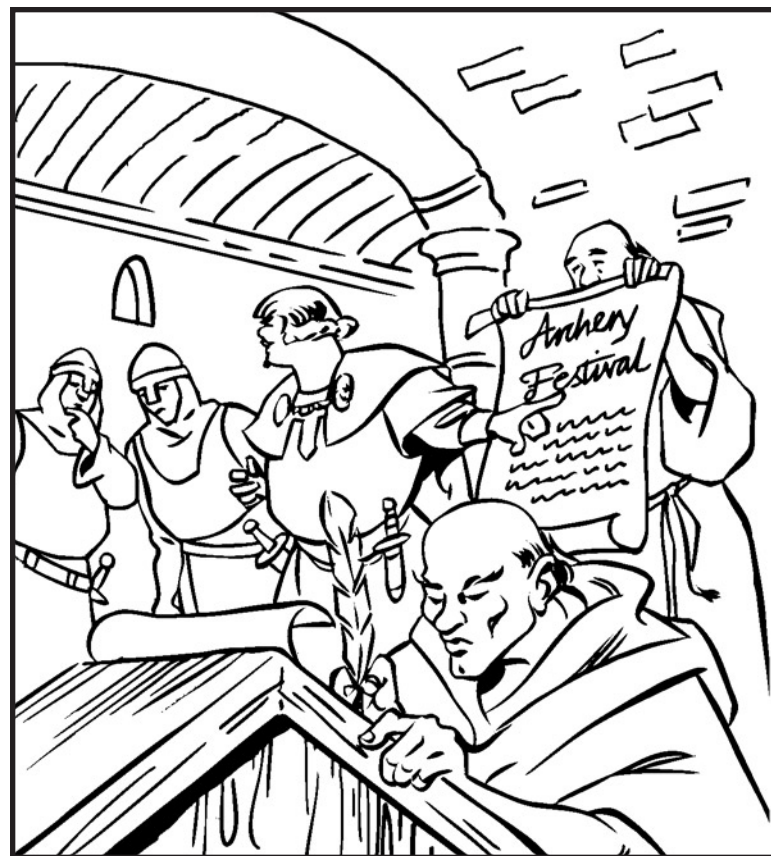
After witnessing these injustices for so many years, Robin Hood launched a campaign to steal back what had been stolen. To accomplish this, Robin and his men would rob wealthy travelers who ventured along the roads near Sherwood Forest. They also stole back unjust taxation money. On some occasions, they would invite corrupt officials into the forest with the promise of a feast. When the lords came to dine, Robin and his men would rob them of their bulging purses and then return the gold they collected to the English people. To his enemies, Robin and his men were hated and feared robbers; to the common people they helped, they were beloved heroes.



The Sheriff of Nottingham

The Sheriff of Nottingham hated Robin Hood with a dark and vengeful heart. He hated that the people loved Robin and protected him. His intense hatred burned inside him, and fueled his anger, often causing him to think unclearly. He wanted nothing more than to catch Robin Hood and hang him in public.

Time after time, Robin escaped the Sheriff's traps. One day the Sheriff sent a stout guard with a **warrant** to arrest Robin Hood. Robin met the guard on the road and invited him to join a feast in the forest. The guard ate so much that he fell asleep. While the guard slept, Robin stole the warrant right out of his pocket! Without a warrant, the guard couldn't arrest Robin Hood and his men. The guard had to return to the Sheriff empty-handed—but well fed.



No matter how often he failed, the furious Sheriff of Nottingham would not give up his hunt for Robin. He knew it was no use sending more guards, no matter the number. "I've got it," said the Sheriff of Nottingham. "I'll catch him by trickery. I'll hold a great archery festival. All the best archers in England will come here to shoot for the prize I'll create, a gold-covered arrow. Surely that will draw Robin Hood and his men to the contest. Then I can arrest and hang them."

Robin Hood and his men prepared to go to the archery contest. They knew that they couldn't wear the familiar green suits they wore to camouflage (CAM-oh-flahzh) themselves in the forest. Instead some dressed as barefoot monks, some as traders, and others as farmers and peasants. Robin Hood was the hardest to recognize, as he was disguised from head to toe in the tattered clothes of a beggar.



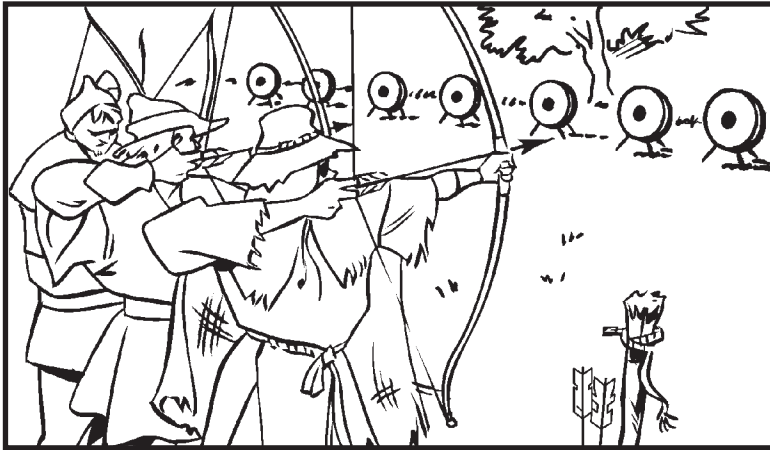
Yet even though Robin was well disguised, his loyal men were worried about his safety. They begged Robin not to go to the festival. "This contest is a trap," warned Little John, Will Scarlet agreed. "The Sheriff and his guards will know you by your hair and eyes, even if you are wearing those old clothes."

Robin Hood just laughed at his band's concern for him. He wasn't afraid. "Why, as to my yellow hair, I can darken the color with walnut stain. As to my eyes, I can cover one of them with a patch so my face will look different in the crowd. The Sheriff of Nottingham and his guards don't scare me. In fact, a bit of danger will make it all the more fun."



The Archery Festival

So the brave Robin Hood left for the contest wearing a beggar's rags, and his well-disguised men all left by different routes. The field where the contest was to be held was quite a sight. Workers had set up rows and rows of benches for the viewers to sit on. Festive glee and anticipation filled the hearts of the people in the crowd. They had all worn their very best clothes for the occasion. All the wealthy lords were dressed richly and were strutting like bright **birds of paradise**. The Sheriff had on purple velvet while his lady wore blue velvet. Both outfits were trimmed with pure white fur, and the couple wore broad gold chains around their necks that reflected their prosperity.



The Sheriff looked everywhere in the crowd for Robin Hood. Unnoticed in his rags, Robin was standing not ten feet from the Sheriff. Although he looked closely at every man's face, the Sheriff did not recognize him.

The archery targets had been set up eighty yards away from where the archers were to stand. The targets were so distant that it was difficult to make out the circles clearly. In the first round of elimination, dozens of archers took turns shooting just one arrow, and many of them missed the target completely. The ten best archers, those who had actually hit the target, were then challenged to shoot two more arrows each. The three best archers out of those ten men would then each have three more shots. The prize would go to the archer whose arrow landed nearest to the center of the target.

Finally it was time for the ten best archers to vie for the prize of the golden arrow. The Sheriff glared at the ten men. "I was so sure Robin Hood would be one of the final archers," he grumbled to a guard at his side. "Couldn't one of these men be Robin Hood in disguise?"



"No, sir," said the man-at-arms. "Six of them I know well; they are the best archers in England. There's Gill o' the Red Cap, Diccon Cruikshank, Adam o' the Dell, William o' Leslie, Hubert o' Cloud, and Swithin o' Hertford. Of the other four, one is too tall, one is too short, and one is too lean to be Robin Hood. That leaves only the ragged beggar. His hair and beard are much too dark to be Robin Hood's, and he is blind in one eye. Robin Hood has stayed away.

The guard was glad Robin hadn't fallen for the Sheriff's trap, for he didn't want to see Robin harmed. Robin Hood had many friends among the common people, even among the guards. The Sheriff's own guards had helped Robin get away many times.

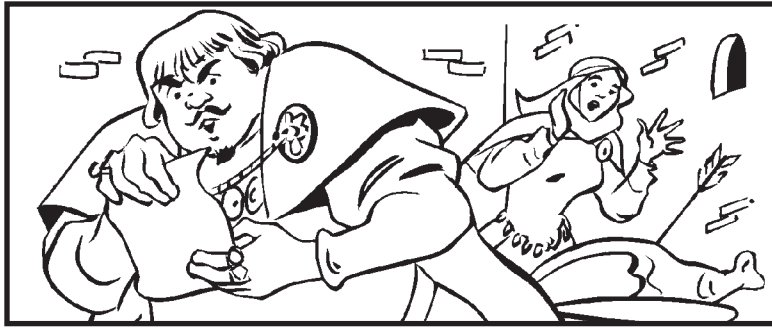


The ten best archers aimed at the distant target and let their **quills** fly. The crowd watched in awe and cheered as each of the arrows struck near the center of the target. When the time came for the last three archers to raise their bows, Gill o' the Red Cap's first arrow struck only an inch from the center. His second and third were even closer. Then Robin Hood, who looked to everyone like the poorest beggar in England, shot his arrow—into the very center! The crowd gasped, then cheered. Adam o' the Dell was to shoot next. Instead, he unstrung his bow when he saw the beggar's arrow strike the center so cleanly. "I've been an archer for forty years," said the man, "and I will never be able to shoot better than that."



And so the tattered beggar won the prized gold-covered arrow. But the Sheriff's face was **scrunched** and sour when the time came to give the arrow to him. "You are the best archer I have ever seen," he said. "You shoot even better than that coward Robin Hood, who dared not show his face today. I will pay you well if you join my service."

"No, I will not," said the ragged stranger firmly, as he walked quickly away. But the Sheriff's words bothered Robin as he walked back to the wood. "I can't bear to have him think I am a coward," he said to Little John. "I will find a way to let the Sheriff know I am the person who won his fine gold-covered arrow."



The Message

The Sheriff was glum that night at the rich supper table with his wife. "I was certain I could catch that thief with this contest," he said to her. "Perhaps Robin Hood was too much of a coward to show his face." Right then, a **shaft** flew through the window and stuck straight into the venison roast on the table. The Sheriff jumped up from his chair and unfolded the note that was attached to the arrow. The note said that the beggar who had won the contest had been Robin Hood himself. It instructed the Sheriff to look closely at the arrow. When he did, the Sheriff realized that it was the very same arrow he had covered in gold and given as the prize! Robin Hood's men had scraped off the gold and kept it.

The **duped** sheriff upended the table and stormed off, madder than he had ever been in his whole life. Nearby, Robin Hood and his men had never been merrier.

Glossary

archers (<i>n.</i>)	people who are skilled at shooting with a bow and arrows (p. 5)
birds of paradise (<i>n.</i>)	birds found in warm climates that have feathers of many different colors (p. 10)
camouflage (<i>v.</i>)	to blend in with one's surroundings (p. 9)
corrupt (<i>adj.</i>)	dishonest; having stopped doing good in order to cheat or gain something (p. 6)
cruel (<i>adj.</i>)	mean; unkind (p. 6)
duped (<i>v.</i>)	tricked (p. 15)
monks (<i>n.</i>)	religious people who usually wear long robes and live separately from the rest of the world (p. 9)
quills (<i>n.</i>)	feathers, especially pointed feathers used in arrows and sometimes as pens (p. 13)
scrunched (<i>adj.</i>)	squashed; wrinkled; puckered (p. 14)
shaft (<i>n.</i>)	the straight wooden part of an arrow (p. 15)
vie (<i>v.</i>)	compete (p. 10)
warrant (<i>n.</i>)	a written order authorizing an arrest or a search (p. 7)

Reading a-z

Book/Topic: _____

[illegible]

Name _____

Instructions: Read the pronouns in the word box. Then read each sentence. Replace the underlined word or words in each sentence with a pronoun from the word box. Write the new sentence on the line.

I	We	his	you	they
It	He	They	him	them

1. The cruel lords became rich by overtaxing the poor.

2. Each man in his band was devoted to Robin Hood and his cause.

3. Robin and his men would rob the lords of their bulging purses.

4. Robin Hood wasn't afraid of the Sheriff.

5. It was a rugged outdoor life that the Merry Men led.

6. Robin Hood will be careful.

7. "The other archers and I will never be able to shoot better than that."

8. "Robin, this contest is a trap meant to lure Robin to your death."

9. The arrow crashed through the window.

10. Robin and Robin's men had never been merrier.

Name _____

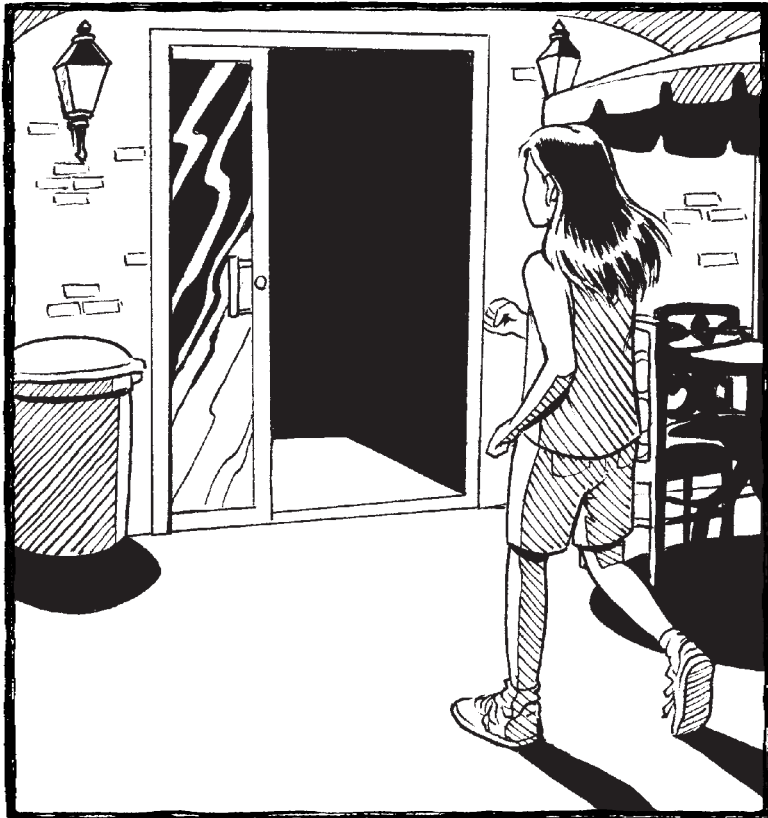
Instructions: Look through *Robin Hood Wins the Sheriff's Golden Arrow* to find twelve adjectives. Write them in the first column. Write a synonym for each adjective in the second column. At the bottom of the page, use two of the synonyms in two sentences. Use a thesaurus or dictionary if you need help.

Adjectives	Synonyms
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
My Sentences:	

Mystery in the Moonlight

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Word Count: 1,617




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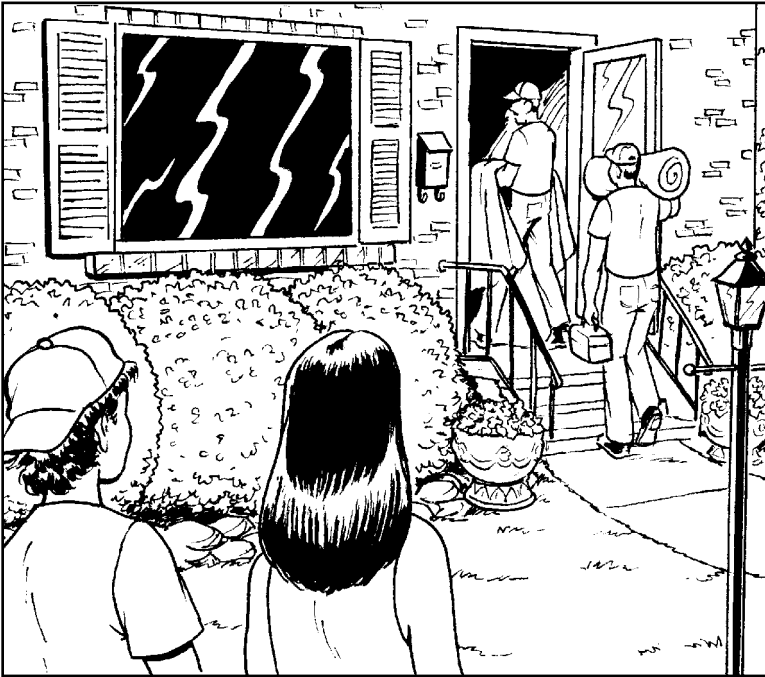
Mystery in the Moonlight



Written by Abigail LaMarine
Illustrated by Tad Butler

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Correlation

LEVEL U	
Fountas & Pinnell	Q
Reading Recovery	24
DRA	40

Table of Contents

Chapter 1.....	4
Chapter 2.....	7
Chapter 3.....	9
Chapter 4.....	10
Glossary	16



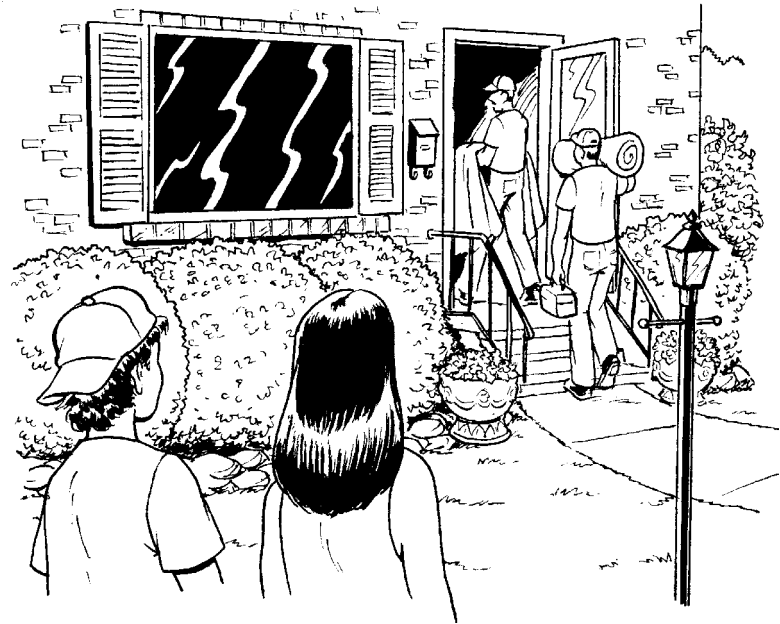
Chapter 1

Nico and Isabel Lopez were twins, but other than being born on the same day, they were almost nothing alike. They were **fraternal twins**, not **identical twins**. Nico was solidly built and darkly handsome, with a wild mane of unruly hair like his father's. Isabel was lighter, with flashing green eyes, a sprinkle of freckles on her nose, and long, silky hair like her mother's. Since the day they were born, Nico had been the thoughtful, quiet one, while Isabel spun their world with adventure and mischief. They were as different as night and day, but their personalities complemented each other's perfectly. They made friends easily but—like most twins—they remained closest to each other.

It had been a long, full summer in their neighborhood. Grady and Jessica Peterson, the twins' good friends who lived up the street, had built a huge tree house in their yard. Most everyone on the block had slept over at least once, eating Mrs. Peterson's s'mores and telling stories late into the warm night—the scarier, the better, of course. With their tree house, Grady and Jessica had been the center of attention that summer for sure. Most kids, Nico and Isabel included, were now hatching **plots** to get their parents to build tree houses, too.

The only other big news was that the house across the street, the one that had been vacant since last spring, had finally sold. A new family had moved in, and Mr. Lopez had heard from the real estate agency that they were named Bradford, and that they had a ten-year-old son named Andrew. This was great, except that no one had gotten so much as a glimpse of him.

In fact, the whole Bradford family seemed absolutely invisible. One afternoon, Isabel and Nico were playing in their front yard when an enormous truck from "Draperies, Etc." pulled up in front of the Bradfords' house. The twins tried to be **casual** about glancing over at the house while men redid every window treatment,



putting up both blinds and drapes. Once they were done, not a thing could be seen inside.

"I guess they like their privacy," Nico said.

"That's strange," Isabel said. "I was hoping to meet the boy who lives there—maybe play some kickball, but I've never seen him at all." Isabel was good at kickball and never missed an opportunity to **recruit** fresh players. Nico chuckled, knowing how frustrating it must be for Isabel not to be able to make friends right away.

"I think there's something odd about that family," she said.

Chapter 2

Another night, when the moon was full, Isabel quietly, but urgently, knocked at Nico's bedroom door.

"Isabel, it's late. What's up with you?" Nico asked. Isabel had her binoculars in her hand, and she climbed on Nico's bed to peek out his window.

"Shh! Andrew Bradford is outside," Isabel whispered. Nico peered through the binoculars and saw Andrew Bradford climbing the old oak tree in the Bradfords' yard.

"This certainly seems like a funny time to be out climbing trees, if you ask me," Isabel said. Nico looked around the yard and saw Andrew's parents sitting at the patio table, happily playing cards by moonlight.

Isabel looked very **intent** and a little mysterious. "Don't you think it's strange that the Bradfords are never outside during the daytime, and that all their windows are covered? You've seen those creepy horror movies just like I have. Don't all these **coincidences** sound familiar?"

Nico rolled his eyes. "Maybe they work at night, Isabel. I don't know . . . I'm sure there's a logical explanation."



"Nico, that kid hasn't come out in the daylight even once since they moved in almost a month ago. Remember when we moved here? The first thing we did

was check out the neighborhood for kids our age. You and Grady were best friends by the end of our first week, remember?" Isabel asked.

"Yeah, I do remember that, but some kids are just shy, and that doesn't make them monsters. You know, we could go over there and introduce ourselves, but . . . let's just wait a day or so and see what happens."

"Okay, but I think something very weird is happening here." She leaned in to whisper in Nico's ear, "Maybe it's even something spooky, and I think you've forgotten how to use your imagination."

"That's okay, Is. You've got enough imagination for both of us," Nico said. Isabel looked annoyed and a little hurt. She sighed and went back to her room.

Chapter 3

The next few days were a blur of activity as school began, and everyone was busy settling into their new routines. That first morning at the bus stop, all the kids watched the Bradford house to see if Andrew would show. He didn't, and the "Andrew mystery" was soon lost in the shuffle of first-day jitters and finding out who everyone's teacher was going to be. The days were still long, however, so there was some evening playtime left for the tree house and for lazing around, time for finishing off the last of the wild blackberries. Talk turned once again to the mysterious Andrew Bradford and the latest sighting of his moonlight **escapades**. Theories were many and wild, but most focused on bloodsucking monsters of one kind or another.



Chapter 4

One particular night, Nico, Isabel, Grady, and Jessica were playing a little twilight kickball with other kids from the neighborhood. Isabel nailed one—straight over their heads and into the Bradfords' yard. Everyone looked toward the house in stunned silence.

"Well," whispered Isabel bravely, "I guess I'll have to climb over there and get it. We'll find out once and for all if he's really a werewolf, a vampire, or what . . ."

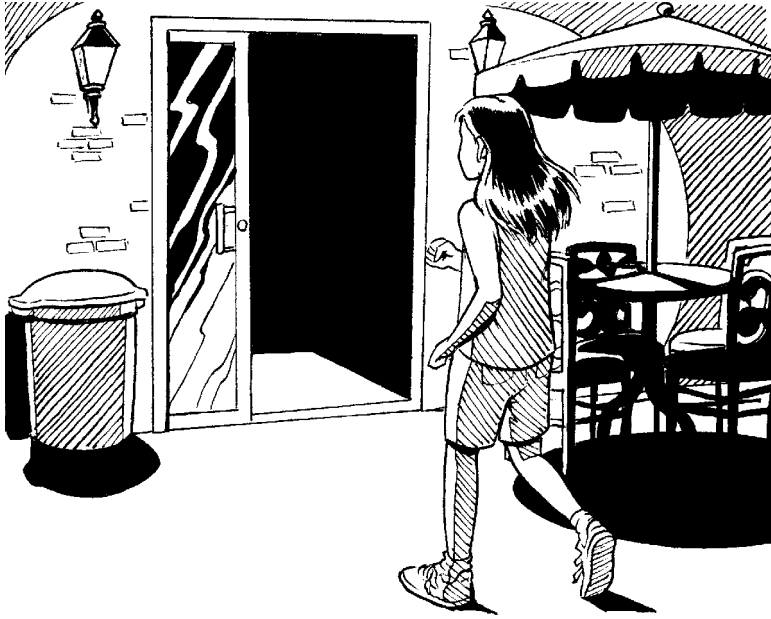
"Um, that's okay, Is. It's getting dark. Let's wait until tomorrow," suggested Grady, kicking the toe of his sneaker into the ground and looking nervous.

Jessica nodded, taking a step backward and looking at her watch. "It's late," she mumbled.

"No, Isabel is right," Nico said, walking over and taking his sister's hand. "I'll go with her, and we'll see what's going on."

Nico and Isabel shared a glance they'd shared many times before. They would always be there for each other—no matter what.

The last of the evening light was fading fast. As they cleared the fence that surrounded the



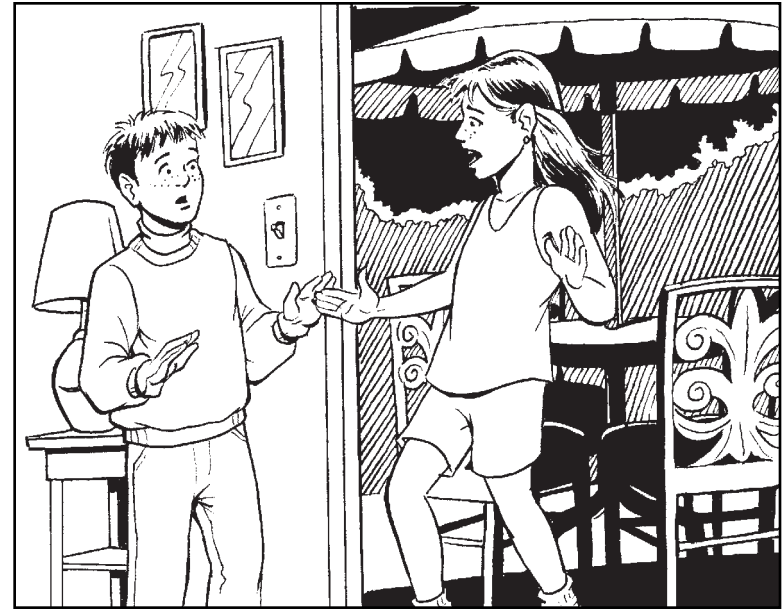
Bradford's yard, they heard the familiar, high-pitched clattering of bats beyond the trees. The bats had begun their nightly hunt for food.

They shared another glance. Was this a sign?

They clutched each other's hands tightly and headed for the far side of the Bradford's property.

"There it is." Nico bent to retrieve the ball from between some shrubs. Then he turned and stared. Isabel was quickly walking away from him toward the open sliding door on the patio. "Isabel, come back!"

Just as she reached the **threshold**, a young boy appeared. He looked a bit small for ten.



"Hi there," squeaked Isabel, and then she drew herself up straight and said firmly, "You must be Andrew. I'm Isabel Lopez, and that chicken over there is my twin brother, Nico."

"So much for loyalty," grumbled Nico.

Andrew seemed at a loss for words, but he finally managed a small "Hello." He didn't look like a werewolf or a vampire, or any kind of monster at all. He did have a whole lot of freckles, and he was covered with clothing from head to toe on one of the warmest nights of the year. But there was no fur or bloody fangs anywhere.

"Sorry to bust into your yard like this, but our ball went over the fence, and . . ." Isabel's voice trailed off.

Nico yelled from where he stood, "My sister wanted to see if you were some kind of monster, since you never come out in the daytime."

Isabel threw her hands over her face with embarrassment, but Andrew just started to chuckle. Then the chuckle turned into a very loud, long laugh.



"Well, you're honest, aren't you? Let me go get my mom and dad. They're probably wondering who I'm talking to. Then we can tell you all about the big mystery."

Mr. and Mrs. Bradford appeared a moment later. After introductions, the Bradfords explained the reason for their family's odd behavior.

"Andrew has a condition called XP. The XP stands for **Xeroderma Pigmentosum** (ZE-ro-DER-ma PIG-men-TOH-sum). His skin and eyes just can't **tolerate** light from the sun. He gets sunburned almost immediately, and it takes a long time to heal. Other than that, he is just like you in every way. As much as we'd love to live lives like yours, it's pretty tough to do without sunlight," Mr. Bradford said.

"Andrew's playtime is limited to moonlight only, so we've adjusted our lives to his. It makes finding friends in a new place a bit of a challenge, I'm afraid," Mrs. Bradford added.

Isabel and Nico tried not to stare. This was a lot to swallow all at once, but suddenly, Isabel's face lit up.

“Hey, Andrew, since it’s dark now, would you like to meet some more of the neighbors? There’s this really cool tree house, and we play kickball, and . . .” Isabel babbled excitedly while Andrew’s parents nodded with approval. She and Nico led Andrew toward his new friends.

The annual Halloween block party was never better. Under a full moon, the neighborhood celebrated the night with its newest members. Isabel came as a fairy princess, and Nico was a wise old wizard. Grady and Jessica Peterson were pirates. And, to everyone’s surprise, Andrew Bradford came as the most convincing vampire anyone had ever seen.



Glossary

casual	relaxed, easygoing (p. 5)
coincidences	similar or related things that happen at the same time by accident (p. 7)
escapades	adventures (p. 9)
fraternal twins	twins who are born at the same time but are not identical (p. 4)
identical twins	twins who look exactly alike (p. 4)
intent	intense, focused, and determined (p. 7)
plots	plans; schemes (p. 5)
recruit	bring someone in to join (p. 6)
threshold	part of a door that sits on the ground; any place that marks the entrance to a building or room (p. 11)
tolerate	to be able to bear or stand something (p. 14)
Xeroderma Pigmentosum	a disorder that causes someone to have strong, painful reactions to sunlight (p. 14)

Name _____

INSTRUCTIONS: Find the mystery-story elements from *Mystery in the Moonlight* and write them down in the correct box.

Detectives	Mystery
Clues	
Foreshadowing	
Red Herrings (Clues that Didn't Help Solve the Mystery)	
Solution	

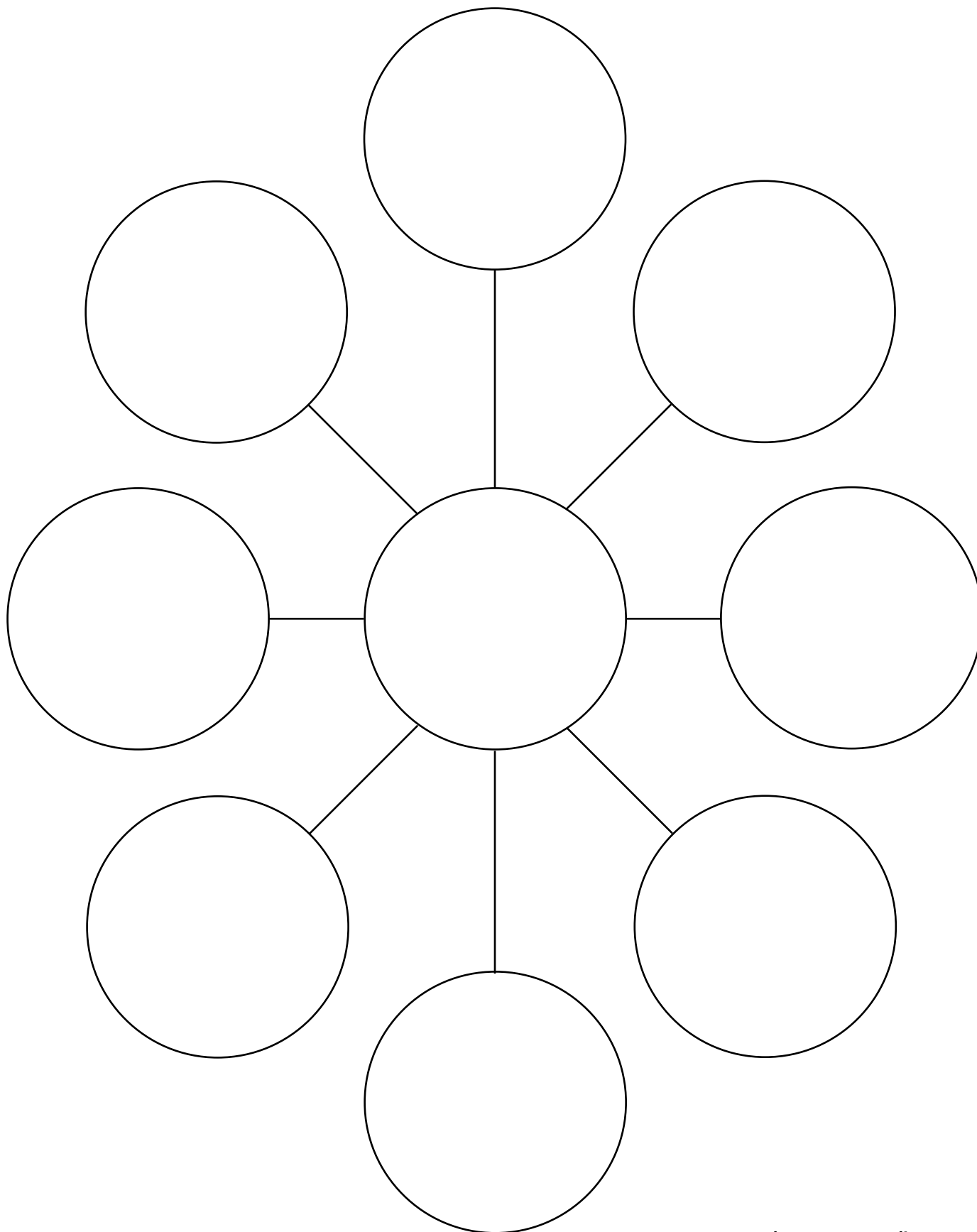
Name _____

INSTRUCTIONS: Write the different forms of the verbs in the columns on the chart.

Verb	Present	Past	Future
to look	look	looked	will look
to run			
to feel			
to eat			
to dance			
to explore			
to sing			
to paint			
to try			
to share			
to reach			
to grow			

Name _____

INSTRUCTIONS: Choose either Nico or Isabel, and write his or her name in the center of the character web. In the outer circles, write words and phrases that visually describe the character you chose.



Australia

A Reading A-Z Level U Leveled Reader

Word Count: 1,704




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Cover: Koala bear

Title page: Sydney Opera House

Back cover: Twelve Apostles rock formations on the Australian coast

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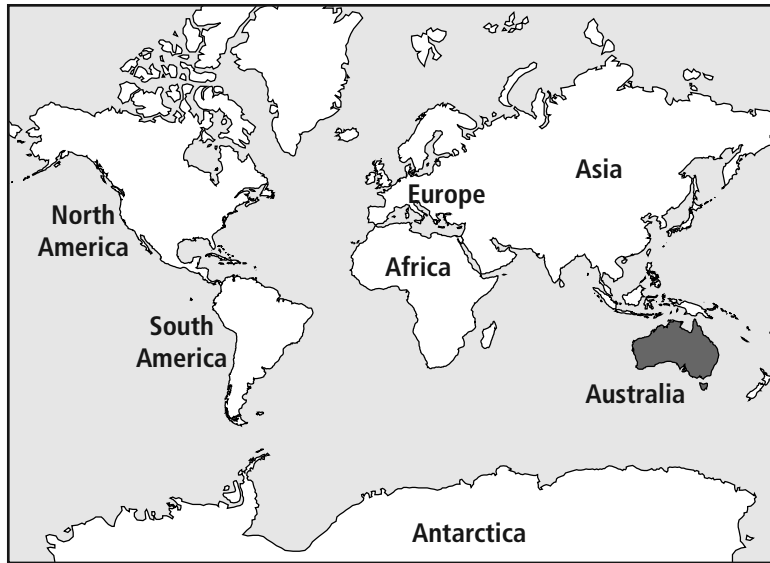
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Reading Recovery	24
DRA	40



Australia is one of the world's richest natural areas.

Table of Contents

Introduction.....	4
Geography	6
Animals.....	8
The Outback.....	11
History	13
Modern Australia	19
Explore More	23
Glossary	24
Index	24

Introduction

The official name of Australia is the Commonwealth of Australia, but Australians call their land "Oz." It is a place so unique, it might have come from a fantasy story rather than real life. Many of the things you see in Australia, from the incredible landscapes to the amazing creatures, are unlike anything else on Earth.

Australia has a rich and fascinating history. A group of people called Aborigines has lived in Australia for over 40,000 years. Britain claimed Australia just over 200 years ago. Since then, the country has changed from a small **colony** to a nation with approximately 20 million citizens.

Australia's population is also unique. Although Australia has lots of industry, most areas have almost no people. Those under-populated areas are known as the Outback, and the people who live there have a frontier spirit, even in this day. However, most Australians live in cities and lead modern lives.

To learn more about the fascinating country called Australia, simply turn the page. Welcome to Australia!



Most Australians live in coastal cities and towns, such as Sydney.

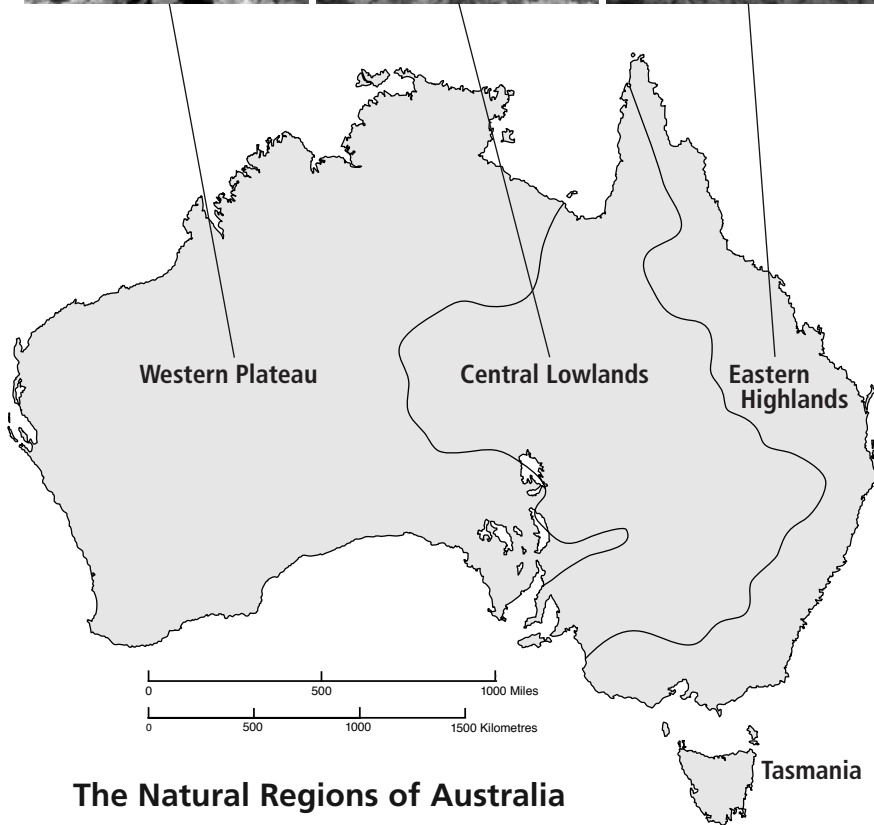
Geography

Australia is the only country that is also a **continent** (landmass). Australia is the oldest continent, at 40 million years old, the smallest continent, and the world's largest island! It is also the world's flattest continent. Australia is the sixth largest country in the world. It is as large as the United States (not counting Hawaii and Alaska). The continent covers 7,772,535 square kilometers (3,842,674 sq mi.) of land.

Australia is located in the southern **hemisphere** (half of the earth). The Indian Ocean borders Australia on the west and south, while the Pacific Ocean surrounds the northern and eastern edges. The country of Australia includes the island state of Tasmania, which is 240 kilometers (150 mi.) off Australia's southern tip, across the Bass Strait.

There are three main areas in Australia: the Western Plateau, the Central Lowlands, and the Eastern Highlands. The Western Plateau, covering two-thirds of Australia, is a flat, dry, desert area with hot weather. Scientists have found the world's oldest rocks in the Western Plateau. Dry grasslands are found in the Central Lowlands, where it is hot all year during the day,

but can be very cold at night. The Great Dividing Range, part of the Eastern Highlands, holds rivers, valleys, and Australia's highest mountains.



(Clockwise from top left) Kangaroos, crocodiles, koala bears, Tasmanian devils, cockatoos, and frilled lizards have become symbols of Australia.

Animals

Australia's animals are amazing! Because of the continent's isolation and harsh conditions, animals seen nowhere else on Earth have developed.

Today, some of these animals are **threatened** (in danger of dying out and becoming extinct). As cities grow larger, the natural areas have grown smaller. Homes and food for some animals are becoming scarce.

Only in Australia can you find a platypus. This unusual animal has four legs, fur, beady eyes, a tail like a beaver's, a duck's bill, and webbed feet. When a British scientist first saw a platypus, he believed someone was playing a practical joke! An adult male platypus can shoot poison from its ankle. Although a platypus is a **mammal** (a warm-blooded animal that nurses its young), females lay eggs.



Duck-billed platypus

There are around 700 types of Australian snakes and lizards. When one lizard called a thorny devil feels threatened, it inflates with air to look bigger and shows its skin spikes. If it's really scared, it tucks its head between its front legs, and a big spiny knob sticks out on the back



of its neck—like a fake head. A thorny devil can eat 3,000 ants in one meal.

Thorny devil



Koalas eat only one thing: eucalyptus leaves.

Koalas look like teddy bears, but they aren't bears at all. They're actually related to the kangaroo, another common Australian animal. Koalas are the only animals besides **primates** (a group of animals that includes humans, apes, and monkeys) that have unique fingerprints.

The platypus, thorny devil, and the koala are just three of a large number of animals found only in Australia!

Most of Australia's mammals are **marsupials**. A marsupial gives birth to a tiny, helpless baby that lives in a pouch or pocket on its mother's body. On other continents, most marsupials disappeared long ago. But Australia's isolation allowed marsupials to thrive. Kangaroos, wallabies, and koalas are all marsupials.

The animals on these pages are just a few of the large number of creatures found only in Australia!



Uluru, also known as Ayers Rock, is one of the most famous sights in Australia.

The Outback

The Australian Outback is the huge dry inland area. Rain may not fall there for years at a time. There can be hundreds of miles between “towns,” which are usually just a few buildings. The Outback has enormous deserts—the world’s largest desert areas outside the Sahara. There are also some mountainous regions.

There are many colorfully gorgeous sights here: enormous golden plains, red rocks, and purple mountain ranges. The landscape is empty and stretches forever. This is truly frontier country for hardy pioneers.

If you visit the Outback, keep your eye out for wild camels! The animals were brought here in the 1870s as desert transportation. Today, the only wild camels in the world live in the Outback. Some tourist places offer camel tours to visitors.

Some residents of the Outback live and work on enormous ranches called “stations.” Some stations are actually larger than some small countries! Other people work in mining and in oil production. The only city in the outback, Alice Springs, welcomes tourists who come to visit Uluru.



Ranches in the Outback seem to go on forever.

Do You Know?

The Great Barrier Reef, off the coast of Australia, is the largest coral reef system in the world. It is home to more than 2,000 types of fish, many types of coral, and other sea creatures, sea plants, and birds. Just how big is the Great Barrier Reef? You can actually see it from space!





Aborigines lived entirely off the animals and plants they hunted and gathered.

Do You Know?

Aborigines used boomerangs in games, to hunt and fight, and to build fires by rubbing the edges against other sticks. The word "boomerang" simply means "throwing stick." Not all boomerangs were meant to come back to the thrower. By 8,000 BC, the Aborigines invented a "returning boomerang" that would swirl in the air and return to the thrower.

History

The first people living in Australia were the Aborigines. They probably traveled by sea from Asia more than 40,000 years ago. By the time Europeans settled Australia, there may have been close to one million Aborigines in Australia. The early Aborigines were **nomads** (people who moved frequently). They hunted and gathered food in small groups and lived in temporary mud homes. They had at least 300 different languages.

In the 17th century, Dutch, Portuguese, and Spanish sailors viewed Australia from their ships. The Dutch landed in 1606 and explored for around 150 years, but decided the land was worthless. In 1688, the first Englishman, William Dampier, arrived. Although Dampier wasn't impressed with Australia, he wrote a book about what he saw.

Finally, in 1770, an Englishman, Captain James Cook, arrived in Australia. He claimed Australia's east coast for Britain, calling it New South Wales. Because of crowding in British prisons, England established a **convict** colony (a settlement of prisoners) in Australia. The first settlement had



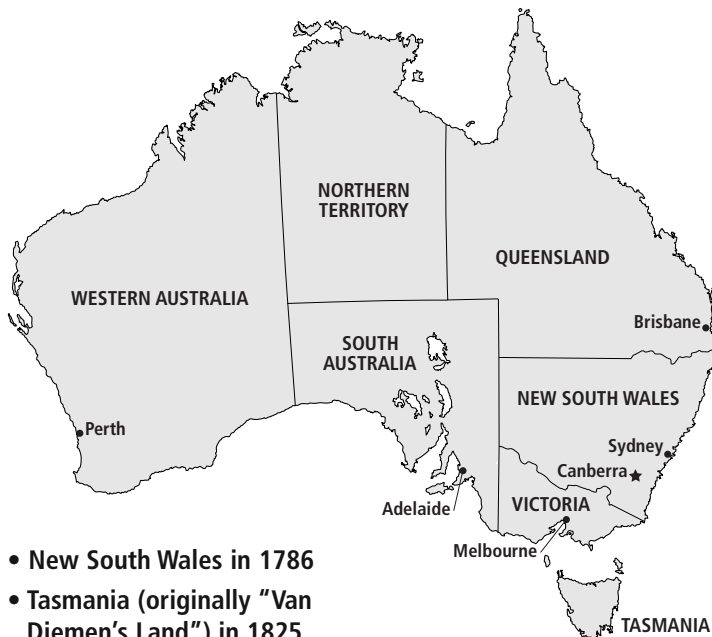
This drawing shows prisoners on a ship sailing to Botany Bay, Australia in 1870.

759 prisoners (568 men and 191 women), 200 soldiers, and 40 wives and children of the soldiers. These people lived in tents and ate native animals and food sent from England.

When that first settlement survived, more settlers began to arrive. Free settlers set up farms, explored the land, and searched for minerals. By the early 1800s, explorers had sailed around Australia and traveled through the interior. Different colonies (groups from distant lands, still tied to the parent country) settled throughout the continent during the 19th century.

Do You Know?

Six colonies were established by free settlers and former convicts during the 1700s and 1800s.



- New South Wales in 1786
- Tasmania (originally "Van Diemen's Land") in 1825
- Western Australia in 1829
- South Australia in 1834
- Victoria in 1851
- Queensland in 1859

The Aborigines did not fare well after Britain began colonizing Australia. Many died due to new diseases brought into the country. Others died because of fighting between the newcomers and the Aboriginal people. In the 1850s, the British forced many of the surviving natives to live on reservations.

Gold was discovered in New South Wales and in Victoria in 1851. In the gold rush that followed, men from all over Australia, as well as European and Chinese immigrants, rushed to the gold fields. Some found gold and became wealthy, while others did not.



A worker pours liquid Australian gold into a mold to create a standard weight gold bar.



Australian soldiers have fought in major wars.

The colonies became states. In 1901, they united under one government and called themselves the Commonwealth of Australia. Britain entered World War I in 1914, with Australia fighting alongside.

A huge **depression** (a period of poverty) struck Australia in 1929. By 1931, one out of every three workers was unemployed, and many were homeless. Business and the economy improved from 1934 to 1937. During World War II, Australians fought alongside Allied soldiers.



Modern Aborigines still fight against discrimination.

Early Australian **immigration** (people moving into a country) laws had allowed mostly northern Europeans to enter the country. This changed in the 1960s and 1970s, allowing more Asian immigrants.

In 1967, voters chose to include Aborigines as citizens in all the states for the first time. Some land rights were given to Aboriginal citizens in 1972. Aborigines, Australia's poorest group, struggle to maintain their rights even today.

Modern Australia

Australia is a democracy, with three levels of government: local, state, and federal. The country's leader, who is chosen by elected lawmakers, is called the Prime Minister. Australians speak English, and they pay for purchases with Australian dollars. Much of Australian culture comes from Britain. Australians still honor the queen of Britain as their ceremonial head of state. In 1999, Australians voted to keep this loyalty to Britain.

In 2003, approximately 20 million people lived in Australia. Of all Australians, about 92 percent are Caucasian, or white, and 7 percent are Asian. Today, 350,000 Aboriginal people live in Australia. Almost every single Australian adult can read!



Much of Australia is open ranch land with few roads.

About 90 percent of Australians live in cities. Australian cities are modern, but they are long distances from each other.

Australia's capital city is Canberra, which is within New South Wales. Although it is the center of politics and government, it has some small-town charms. There are only around 500,000 residents. The city has art museums, the High Court of Australia, the Australian National University, and other important places.



Visitors look down on Canberra.



Sydney's opera house is one of the most famous and unusual buildings in the world.

Sydney is Australia's largest city, with a population above 4 million. Within the city lie a business district, Chinatown, The Botanic Gardens, museums and art galleries, and many old buildings. Surrounding the city are national parks filled with plants and animals. Sydney is also home to some of the most beautiful beaches in the world.

Australia's other big cities include Melbourne, Brisbane, Perth, and Adelaide. Like almost all of Australia's cities, these are right along the coast.



While Australia has little farmland, it is rich in minerals and precious gems.

At one time, the wool industry was Australia's largest business, but that is no longer the case. Major Australian industries include mining, the manufacture of industrial and transportation equipment, construction, food processing, chemicals, and steel. Some new industries are winemaking and tourism.

The country's natural resources include **bauxite** (a claylike material from which aluminum is obtained), coal, iron ore, copper, tin, silver, uranium, nickel, natural gas, and petroleum. Australia also exports meat, wool, wheat, sugar, and machinery. Australia is the world's largest producer of diamonds.

Explore More

❶ At the Library

Ask your school or local librarian to help you find information about Australia. You can look up books on Australian history, the Outback, Aborigines, and modern Australia. You can also find many books on unusual Australian animals, such as kangaroos, wallabies, and koalas.

❷ On the Internet

- In the address window, type *www.google.com*.
- Pick a subject you'd like to explore, such as the Outback, and type it in the search window. Click on "Google Search."
- Read the colored links. Click on one that looks interesting.
- If you want to explore more links, click on the "Back" arrow on the top left.
- Try searching for other subjects, such as *kangaroos*, *Aborigines*, *Sydney*, or other topics.

❸ In the Media

Australia produces a diverse selection of movies, music, art, and theater. Ask your teacher, parent, or librarian to help you find films that take place in Australia or music that comes from Australia. You might be surprised by the richness of Australia's landscape and modern culture.

Glossary

bauxite	a claylike material from which aluminum is obtained (p. 22)
continent	mass of land (p. 6)
colony	a group settled in a distant land, yet closely tied to the parent country (p. 4)
convict	prisoner (p. 14)
depression	a period of poverty (p. 17)
hemisphere	half of the earth (p. 6)
immigration	people moving from one country to another (p. 18)
mammal	a warm-blooded animal that nurses its young (p. 9)
marsupials	mammals that keep their young in a pouch on the female's body (p. 10)
nomads	people who don't have a permanent home (p. 13)
primate	an animal such as a human, ape, or monkey (p. 10)
threatened	in danger of dying out (p. 8)

Index

Aborigines, 4, 13, 16, 18, 19	Outback, 5, 11, 12
Cook, Captain James, 14	New South Wales, 15, 16, 20
Great Dividing Range, 7	Sydney, 15, 21
koalas, 8, 10	Tasmania, 6, 15

Name _____

INSTRUCTIONS: Write the main idea and important details for each of the chapters listed on the chart below.

Chapter	Main Idea	Important Details
Animals		
The Outback		
History		
Modern Australia		

Name _____

INSTRUCTIONS: Circle the possessive pronoun or contraction that correctly completes each sentence.

1. Pack (you're, your) camera when you visit Australia.
2. (It's, Its) a unique and beautiful country.
3. A platypus lays two eggs that attach to (it's, its) belly.
4. (Who's, Whose) the first European to land in Australia?
5. (You're, Your) likely to see a kangaroo when you visit Australia.
6. A boomerang returns to (it's, its) thrower.
7. Keep (you're, your) eye out for wild camels in the Outback.
8. The Aborigines, (who's, whose) lands were taken from them, are still fighting for their rights.
9. Canberra has kept (it's, its) small-town charm.
10. The wool industry is no longer (it's, its) largest industry.
11. If (you're, your) interested in diamonds, Australia is a good place to visit.
12. Some of (it's, its) other industries are food processing, chemicals, and steel.



Name _____

INSTRUCTIONS: For each sentence, circle the adjective and then underline the word that it modifies.

1. One little lizard can inflate its body.
2. Koala bears are cute but not cuddly.
3. Wild camels can be found in the Outback.
4. The first Aborigines moved from place to place.
5. Canberra is a modern Australian city.
6. The Outback can be a harsh, desolate place.
7. There is a colorful beauty in the deserts of Australia.
8. Many animals in Australia are found nowhere else.



Galapagos Wonder

A Reading A-Z Level U Leveled Reader

Word Count: 1,831




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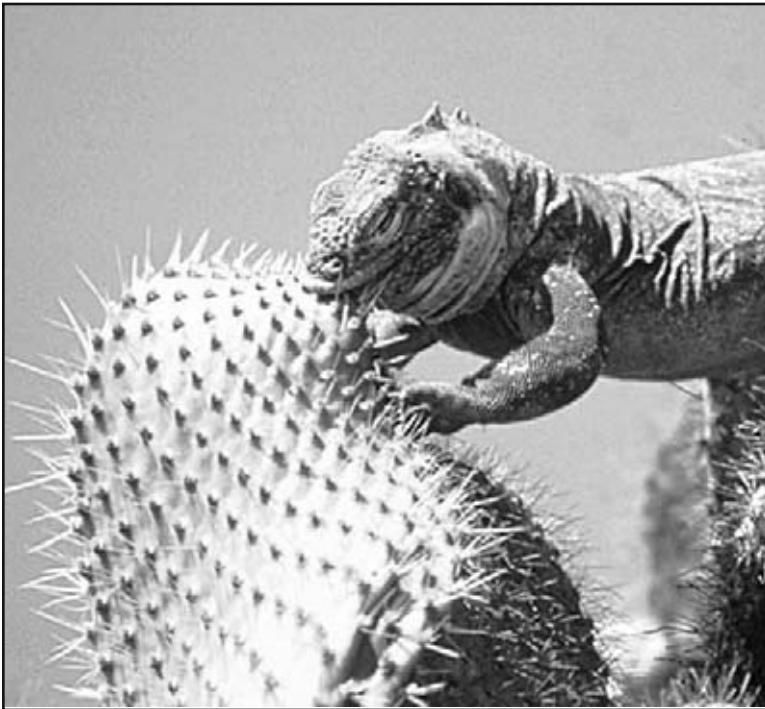
Galapagos Wonder



Written by Kira Freed

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Galapagos Wonder



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www.darwinfoundation.com; all other photos: © ArtToday.

Title page: A land iguana feeding on a cactus

Page 3: A Sally Lightfoot crab, a common Galapagos invertebrate

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Fountas & Pinnell	Q
Reading Recovery	24
DRA	40



Table of Contents

Introduction	4
Location	5
Geology.....	6
First Contact.....	7
Darwin's Visit	8
Wildlife	9
Plant Life	16
Threats to Survival.....	18
Conclusion	22
Explore More	23
Glossary	24
Index	24



Marine iguana



Galapagos tortoise



Galapagos penguin

Introduction

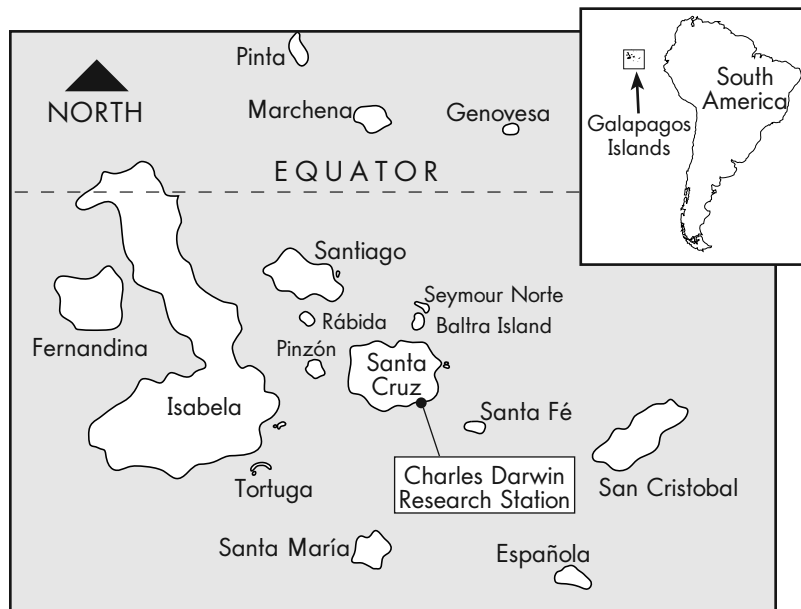
Imagine a place where thousands of black lizards stretch out on lava rocks to soak up the morning sun. Imagine a place where giant tortoises feed on cactus plants that grow as big as trees. Imagine an island on the equator where penguins swim and fur seals rest on coral beaches. Welcome to the Galapagos Islands.

These islands have fascinated people since the first visitors arrived in 1535. The volcanic landscapes and exotic wildlife spark our imaginations. Formed from fire, these islands remind us of the raw power of our planet. And they remind us of rapidly disappearing unspoiled places where nature remains mostly untouched by development and technology.

Location

The Galapagos Islands are located in the Pacific Ocean, about 966 kilometers (600 mi.) off the northwestern coast of South America. They lie along the equator and are part of the country of Ecuador. There are five major islands and many smaller ones of various sizes.

The climate of the islands is surprisingly cool for their location on the equator. This is due to the Humboldt **current**, cold waters that flow north from Antarctica. The cold waters explain why animals usually found in colder climates, such as penguins and sea lions, can live in the Galapagos.



The rugged coastline is an attraction of the islands.

Geology

The Galapagos Islands were created by volcanic activity, and they continue to be among the most volcanically active islands in the world. Scientists believe that the islands are located over a “hot spot” beneath the earth’s crust. Hot spots contain more heat than other areas, causing molten lava to rise up through the crust. Scientists think that each island was formed from solidified lava building up on the sea floor and eventually piling up above the surface of the water.

First Contact

The Galapagos Islands were first discovered in 1535 when a ship carrying the bishop of Panama to Peru was blown off course. The bishop recorded his observations of the islands in a letter to the king of Spain. At that time, there were no humans living on the islands.

During the 1700s and 1800s, the Galapagos became a **refuge** for pirates and whalers due to the islands' remote location. Giant tortoises were a favorite food source because they were easy to capture and keep. The numbers of these gentle creatures were reduced from several hundred thousand to about 15,000 by the year 1800.



Whaling ships often stopped at the Galapagos Islands.



Darwin's visit to the islands at the age of 24 helped him develop the theory of natural selection.

Darwin's Visit

The most famous visitor to the Galapagos Islands was Charles Darwin, a British **naturalist** who sailed there in 1835. He collected many wildlife **specimens** and wrote detailed accounts of his observations.

Darwin was fascinated by the amazing **diversity**, or variety, of life on the islands. He noticed that similar **species**, or kinds, of animals developed different traits on different islands. Because of his work, we now understand much more about variety in nature.

Wildlife

Scientists and tourists alike have been fascinated by the diversity of native animal and plant life on the Galapagos Islands. New species are continually being discovered. A 1996 expedition took scientists 914 meters (3,000 ft.) under water to study the ocean surrounding the islands. Many new species were discovered, including jellyfish, deep-sea moray eels, sea cucumbers, and a deepwater red octopus. The scientists discovered a new species of marine life on almost every day of their expedition.



The 1996 expedition used the *Johnson Sea Link Submersible*.

Reptiles

Some of the Galapagos' most famous residents are its reptiles. The islands were named for one of the most well-known reptiles, the giant tortoise. (*Galapagos* is Spanish for tortoises.) These gentle **herbivorous** (her-BIV-oh-rus) reptiles can live 150 years or more. Males can grow to 1.8 meters (6 ft.) in length and can weigh up to 300 kilograms



Dome-shaped shell

(660 lbs.). Fourteen different kinds of Galapagos tortoises used to exist. Several kinds have become extinct, and the others are now protected.

Galapagos tortoises are divided into two groups based on the shape of their shell, or **carapace**. One group has a round, dome-shaped shell, a short neck, and short legs. The other group has a saddle-shaped shell that is raised in front, a long neck, and long legs.



Saddle-shaped shell



A marine iguana

Marine iguanas, the world's only seagoing lizards, are another well-known Galapagos reptile. They have been compared to small dragons because of their leathery skin, curved claws, and back spines. They can grow to a length of 1 meter (3 ft.). These tropical lizards are able to stay under water for up to an hour while feeding on red and green algae, their main food source.



Do You Know?

Marine iguanas have special glands connected to their nostrils that help them get rid of the extra salt they get from drinking seawater. It may seem as though these animals are often sneezing, but they're just getting rid of salt.

Marine iguanas gather on shore.

Marine iguanas have dark skin that helps them absorb the sun's heat after they emerge from the cold ocean waters. Marine iguanas also control body temperature with their posture. They often sun themselves on lava rocks as the sun rises in the morning. When the heat becomes too intense, they raise up on their legs to protect their underside from the hot rocks and to increase air circulation. After a day in the cold ocean waters, they pile up together at night to conserve body heat.

Mammals

Many Galapagos mammals are animals normally found far from the equator. Galapagos sea lions are the marine gymnasts of the islands. Their playful antics amuse tourists, who sometimes receive friendly nips from these animals. Sea lions live in large colonies. Female sea lions, known as cows, gather on beaches to nap. Adult males, or bulls, are **territorial** and extremely aggressive during the mating season.



Sea lion

Galapagos fur seals are rarer than sea lions. Fur seals were hunted nearly to extinction because of their thick fur, which was valuable. Unlike sea lions, fur seals live in smaller groups and prefer steep, rocky shores. They fear humans and are difficult to approach.



Fur seal

Birds

Many of the Galapagos' most interesting residents are birds. Frigate birds are among the most striking birds in the world. They can measure up to 1 meter (40 in.) tall and have a wingspan up to 2.1 meters (7 ft.). During the mating season, hundreds of males gather to attract the attention of females. Each male inflates his bright red throat sac like a balloon while shaking outstretched wings and making repeated piercing cries.



Do You Know?

A male frigate bird can inflate its throat sac to the size of a soccer ball.



Galapagos penguin

Galapagos penguins are among the most surprising native animals on the islands. We usually think of penguins as living close to Antarctica. Galapagos penguins are the most northern penguin. They weigh only 2 to 2.5 kg (4.5–5.5 lbs.) and stand 40 to 45 cm (16–18 in.). One of their big challenges is to stay cool in the tropical heat. They do this by holding out their wings so that air moves around the sides of their bodies. They also stay cool by keeping their feet shaded or by taking a refreshing dip in the ocean.

Galapagos penguins swim under water at high speeds, using their wings as propellers and their feet as rudders. They feed on small fish that they catch by hunting in groups. They live in colonies and mate for life.



Scalesia forest

Plant Life

The plant life on the Galapagos Islands is just as remarkable as the animal life. There are about 560 kinds of native plants, and almost one-third of them are found nowhere else on Earth.

The scalesia (ska-LEE-zee-yuh) tree is a unique Galapagos plant. It is a member of the daisy family and can grow to a height of 24 meters (78 ft.). It grows in humid areas at higher elevations and is often covered with tropical flowers called orchids.

The prickly pear cactus grows low to the ground on many of the islands, but on the island of Santa Fe it grows into trees. The pads, flowers, and fruit of this cactus are a favorite food of land iguanas. They often roll the cactus pads on the ground to remove the spines before eating them. These creatures often sit under a tree waiting for a pad to drop to the ground.



A tree-sized prickly pear cactus

Threats to Survival

Almost all of the island chains in the world have experienced the loss of many of their native plants and animals. The Galapagos Islands have lost few native life forms so far, though serious threats exist.

The most serious problem is the presence of non-native species brought by humans. Cats, dogs, pigs, goats, horses, donkeys, cattle, and rats have all been brought to the islands. Many of them have become **feral**, or wild, and have multiplied rapidly.



Cows and other non-native animals interfere with the native ecology.

Tortoise eggs and hatchlings are eaten by many feral animals, as are other native animals. Feral animals also eat plants that native animals would otherwise eat. The islands have many programs to destroy the non-native animals so that the native **ecology** can be restored. And scientists are raising tortoises in captivity to try to boost their numbers and increase their survival rates.

Another serious problem is the increasing number of people on the islands, both residents and visitors. In 1940, only 600 people lived on the islands. But in 1949, many people moved to the islands after a major earthquake in Ecuador. Tourism in the Galapagos Islands skyrocketed in the 1980s, bringing more residents and many more visitors. By 1997, the population on the islands had grown to about 15,000.

With more people come many risks. New harmful species are more likely to be brought to the islands. Natural resources are being overused for building materials and firewood. More animals are being hunted for food and export, both on land and in the ocean. Pollution from tourist and supply boats is increasing. In 2001, an oil tanker ran aground off one of the islands, causing a huge oil spill. Experts from around the world worked with the government of Ecuador, local scientists, and others in a massive cleanup effort.



The oil tanker *Jessica* runs aground.

To help preserve the Galapagos Islands, the government of Ecuador declared 95 percent of the land a national park in 1959. In 1986 a law was passed to protect 69,930 square kilometers (27,000 sq. mi.) of the ocean waters around the islands.

Strict laws now limit visitation to the islands. Visitors must be accompanied by certified guides who are trained to keep conservation in mind at all times. Visitors are not allowed to bring food or drink in order to prevent the introduction of foreign plant seeds, insects, or bacteria. The laws also protect animals and plants from human interference, such as touching, feeding, or littering.



Boat tours are carefully controlled to help protect the wildlife.



Scientists feed a bird rescued from the 2001 oil spill.

In 1959, the Charles Darwin Foundation was created to help the government of Ecuador make smart decisions about conservation on the islands. This foundation operates the Charles Darwin Research Station on Santa Cruz Island so that scientists and the public can continue to learn about these extraordinary islands. Many educational programs, both on the islands and around the world, help teach the public about Galapagos conservation efforts.



The isolation and ruggedness of the Galapagos Islands might help preserve their unique ecology.

Conclusion

Our planet is now facing the mass extinction of up to 75 percent of all life forms. The Galapagos Islands are one of the last places on Earth that contain so many rare life forms in such a small area. Many are found nowhere else on Earth.

Scientists, conservationists, and other concerned people who value nature are working to safeguard the Galapagos Islands for future generations. These islands are a natural treasure that must be preserved and protected.

Explore More

At the Library

Ask your librarian to help you find books on the Galapagos Islands. You can find books of Galapagos photographs, history, and modern science. You can also look for books on individual plants and animals from the Galapagos. You may even find travel books in which people describe their trips to the islands, some of them written long ago.

On the Internet

- A. In the address window, type *www.google.com*.
- B. Type *Galapagos* in the search window and click on "Google Search."
- C. Read the colored links. Click on one that looks interesting. When you want to explore other links, click on the "Back" button at the top left to return to the Google search page.
- D. Try other searches, such as *Charles Darwin*, *Galapagos tortoise*, or *frigate bird*.

Glossary

carapace	a tortoise's upper shell (p. 10)
current	a flow of water as in a river or ocean (p. 5)
diversity	a wide variety of many things (p. 8)
ecology	the environment and natural conditions of a place (p. 18)
feral	escaped human control and run wild (p. 18)
herbivorous	eating plants (p. 10)
naturalist	a scientist who studies nature (p. 8)
refuge	a place where something can be safe (p. 7)
species	kinds of animal (p. 8)
specimens	examples of something used for study (p. 8)
territorial	fiercely guarding a personal area (p. 13)

Index

Darwin, Charles, 8, 21
frigate bird, 14
lava, 4, 6, 12,
scalesia, 16
tortoises, 4, 7, 10, 18

Name _____

INSTRUCTIONS: Write the main ideas and important details for each of the sections listed on the chart. Use the information to write a short summary for each topic.

Reptiles	
Main Idea:	Summary:
Important Details:	
Mammals	
Main Idea:	Summary:
Important Details:	
Birds	
Main Idea:	Summary:
Important Details:	
Threats to Survival	
Main Idea:	Summary:
Important Details:	

Name _____

INSTRUCTIONS: Use an adjective in the box to complete the two-word noun in each sentence.

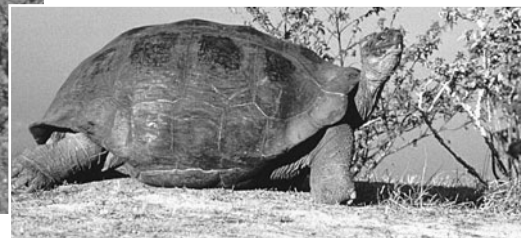
prickly
Galapagos

marine
sea

Pacific
frigate

hot
moray

1. The Galapagos Islands are located in the _____ *Ocean*.
2. Fur seals and _____ *lions* are two mammals on the islands.
3. The most famous resident is the _____ *tortoise*.
4. The _____ *pear* can grow to the size of a tree.
5. Scientists discovered a deep-sea _____ *eel*.
6. The _____ *iguana* is a seagoing lizard.
7. The islands were formed over a _____ *spot* in the earth's crust.
8. A male _____ *bird* can inflate its large, red throat sac.



All About Chocolate

A Reading A-Z Level U Leveled Reader

Word Count: 1,698



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LEVEL U	
Fountas & Pinnell	Q
Reading Recovery	40
DRA	40



Table of Contents

Introduction	4
Where Chocolate Comes From	5
Preparing the Beans	8
From Beans to Chocolate	12
History of Chocolate	16
Chocolate Today	20
Try This!	22
Conclusion	23
Glossary	24
Index	24



Introduction

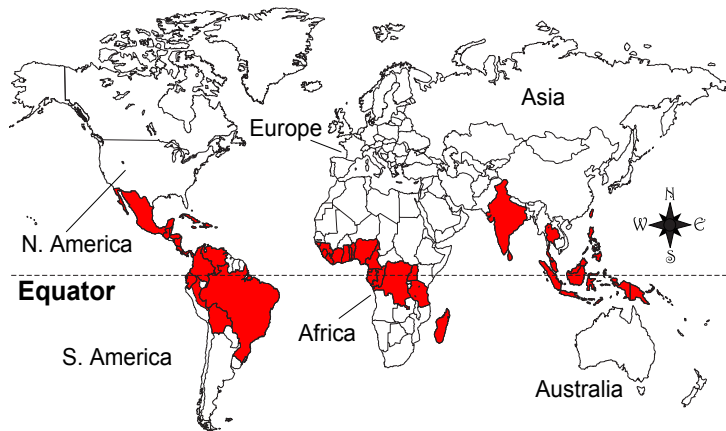
Ask people about their favorite sweet thing to eat, and they'll probably say it's chocolate. People around the world love chocolate. They love it so much that every year they eat more chocolate than any other sweet.

If you have ever wondered where chocolate comes from and how it's made, then read on.

Where Chocolate Comes From

It might surprise you to learn that chocolate actually grows on trees. That doesn't mean that you can pick a chunk of chocolate from a tree branch and eat it. In fact, the chocolate growing on trees looks, tastes, and smells nothing like the chocolate you eat.

The tree that gives us chocolate is the **cacao** (kah-KOW) tree. It is an evergreen tree that can grow to be over 40 feet (12.2 meters) tall. Chocolate comes from beans that are found in large pods on the tree. Cacao trees grow where it is hot and wet. Mostly, they grow near the equator. When young, these trees need protection from the wind and sun. But as they grow older, they can grow in full sunlight.



The shaded areas of the map show where cacao trees grow close to the equator, where it is hot.

The cacao tree originated in the Amazon River region of South America.

Through the course of history, the tree spread to other parts of South America, Central America, and Mexico.

It was also introduced to

other parts of the world, including Africa in 1870. Today, more than two thirds of the cacao in the world comes from western Africa. Brazil is the next largest producer.



Cacao trees grow in the wild, as well as on plantations.

Today, most cacao trees are grown on farms called **plantations**. It takes four to five years before a cacao tree begins to grow pods. Cacao trees have large, smooth, shiny green leaves that stay on the tree year-round. They have lots of small white or yellow flowers that bloom during the year. The flowers give off a bad smell that attracts flies to pollinate the plants. Some of the flowers change into pods, but most do not. Only about one out of every ten or twenty flowers will become a pod.

The pods are shaped like little footballs. They grow on the trunk and larger branches of the tree throughout the year. Workers trim the branches to make sure that they get the most pods possible from the trees. The pods are green when they first form, but they change to a golden or reddish color as they get ripe. The pods are picked when they are ripe or mature. Since cacao tree roots grow close to the surface and are easily damaged, workers have to be careful not to step on the tree's roots when they remove the pods.



These pods contain the beans that will be used to make chocolate.



A harvester cracks open cacao pods to get at the seeds.

Preparing the Beans

Taking the pods from the cacao trees is the first step in making chocolate. But it's not the pods that are important—it's the 20 to 50 beans found inside the pods, which are actually the tree's seeds. It takes a lot of beans and a lot of work to make a kilogram (2 lbs.) of chocolate. About 800 beans, removed from 20 to 40 pods, are needed. First, the pods are gathered, and then someone using a large blade called a **machete** (mah-SHET-ee) cuts each pod open with one or two forceful whacks. A skilled pod breaker can break open as many as 500 pods in a single hour.

The beans are then scooped out of the open pod. The beans are not brown, as you might expect. Instead, they are cream colored and covered with a soft pulp. These beans are a long way from being the chocolate you know.



This is what the inside of a cacao tree pod looks like.



A worker spreads the cacao beans so they can dry and then begin the fermentation process.

The pulp-covered beans are put into piles or boxes and covered. As the beans come in contact with the air, they begin to change from a cream color to a purple color. The beans also change on the inside in a process called **fermentation**. Fermentation can take more than a week, but the fermented beans still do not taste or smell like chocolate.

After the beans have fermented, they are dried. The beans are either dried outdoors by spreading the beans on large mats in the sun, or they are taken indoors and dried by hot, dry air blown from pipes. As they dry, the beans are turned. Once the beans are dry, they are placed in large cloth bags and shipped to makers of chocolate.



Workers spread cacao beans to dry in the sun.

From Beans to Chocolate

Making chocolate from the fermented, dried beans is a very long and complicated process. First, the beans need to be cleaned, removing any remaining pulp or pieces of the pods. Then, chocolate makers blend different varieties of beans to make sure the chocolate has just the right flavor.

The cleaned and blended beans are roasted in order to bring out the chocolate flavor. This is the stage when the beans begin to smell like chocolate. As the beans are roasted, the thin shell that covers them grows brittle. The beans pass through a special machine that cracks their shells and blows away the pieces of shell with fans.



Beans roast in giant drums at a candy factory.

After the shells are removed, only the meaty part of the bean, called the nib, remains. The nibs are ground up and crushed until they become a liquid. The liquid is poured into molds where it cools into bars of bitter, unsweetened chocolate. The bars are then pressed until the most important part of the chocolate, a yellow liquid called cocoa butter, is removed. The cocoa butter drains through a screen and is collected to make the chocolate we eat.

After the liquid cocoa butter is removed, the solid part of the bar is ground into a powder. Cocoa powder is sent to dairies and bakeries to flavor baked goods and dairy products.

Word Origins

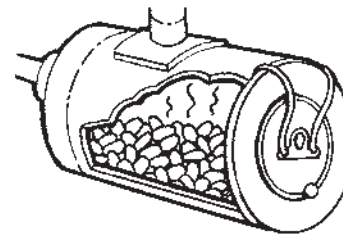
Cacao or Cocoa?

When the products of the cacao tree made their way to English-speaking countries, the Spanish word *cacao* became the English word *cocoa*. Writers and speakers of English today still use the word *cacao* when discussing the tree and its flowers, pods, and beans. People usually use the word *cocoa* when discussing the many products that come from the beans.



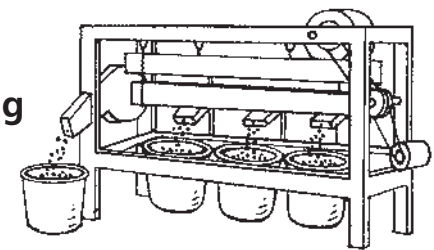
The chocolate we eat is made in the final step, called **conching** (KONCH-ing). Conching takes place in machines with big rollers. A mixture of sugar, cocoa powder, cocoa butter, and other **ingredients**, such as milk and vanilla, is placed in the machines and then rolled and mixed until smooth. The smooth mixture is poured into molds and cooled. After it has cooled and solidified, the chocolate is removed from the molds and wrapped in packages for shipping.

Another popular form of chocolate is white chocolate. White chocolate is made by mixing sugar and milk solids directly with cocoa butter.

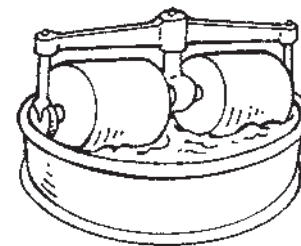


1. Roasting

2. Shelling



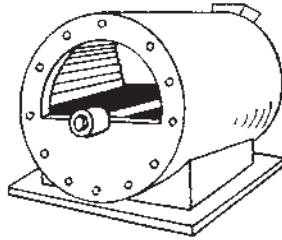
3. Grinding



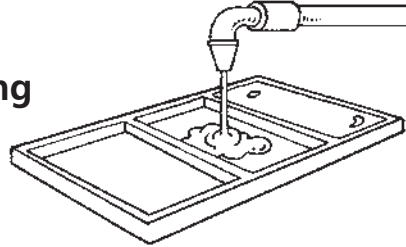
4. Molding



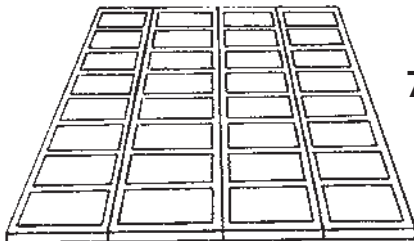
5. Conching



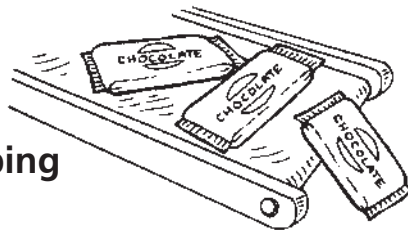
6. Pouring



7. Cooling



8. Wrapping



History of Chocolate

As near as historians can tell, Aztec and Mayan people living in Central and South America were using chocolate almost 2,000 years ago. These people enjoyed a drink called *xocoatl* (pronounced shoh-coh-WAH-tuhl) made from roasted chocolate beans. But if you were to try this drink today, you'd find that it tastes much different than the chocolate drinks you enjoy. In fact, it was a very bitter-tasting drink—kind of like coffee.

When Christopher Columbus returned from his fourth trip to the New World, he brought some cacao beans to show to the king and queen of Spain. But Europeans did not know what to do with the beans, so they mostly ignored them. They were more interested in spices and other things Columbus brought back.

It was not until a Spanish explorer by the name of Hernando Cortez returned from a voyage to the

New World that Europeans began to see that there was value in cacao beans. The great Aztec ruler Montezuma had served Cortez a drink made from cacao beans. The Aztecs told Cortez that it was the drink of the gods. They believed that cacao beans gave them added wisdom and strength. They placed so much value on cacao beans that they used the beans as a form of money. Cortez saw much more value in the beans as money than as a drink. He planted cacao trees so that he could use the beans, not for chocolate, but as money. It was his way of growing money on trees.

Cortez brought back knowledge of how to make the chocolate drink, but it still was not popular outside the New World. Eventually, the Spanish began mixing sugar with the drink, along with cinnamon and vanilla, and serving it hot. The drink soon became very popular among the nobility and the very wealthy. The Spanish valued chocolate so much that they kept the knowledge of how to make it secret from the rest of Europe for almost one hundred years.

The Spanish created many plantations of cacao trees in their colonies in South and Central America to ensure a plentiful source of the beans. During this time, countries at war with Spain would sometimes capture Spanish ships full of

cacao beans and would destroy the cargo as worthless because they had no idea what the beans were used for. It is widely rumored that Spanish monks were the ones who finally shared the secret of how chocolate was made with other Europeans, changing the world forever.

Until the 1600s and 1700s, chocolate was a luxury food for royalty and powerful church officials. But during the 1600s, people began grinding large amounts of cacao beans in **mills**, producing much more chocolate and lowering the cost. The invention of smooth milk chocolate also increased the treat's popularity. The first chocolate shop in London, England, was opened in 1657. In the 1700s, a steam-driven chocolate grinder was invented, allowing factories to quickly make tons of affordable chocolate. Today, chocolate is a favorite and affordable treat in many countries.



Chocolate is enjoyed with gusto by people of all ages.

Timeline

- 200 — The first use of chocolate by people in South and Central America
- 900 — Chocolate used as money by people of South and Central America
- 1502 — Columbus brings cacao beans back to Europe
- 1528 — Hernando Cortez brings cocoa beans and knowledge of how to make a chocolate drink to Spain
- 1657 — A Frenchman opens the first chocolate shop in London, England
- 1828 — Cocoa press is invented
- 1847 — First solid chocolate bar is sold
- 1875 — A man in Switzerland makes and sells the first milk chocolate
- 1894 — Milton Hershey establishes Hershey Chocolate Company
- 1913 — Invention of a method for making chocolates filled with other sweets
- 2007 — World consumes over 3,000,000 metric tons of cacao beans



Some specialty shops sell only chocolate treats.

Do You Know?

Recent medical studies show that there are definite medical benefits in eating chocolate. The benefits are linked to dark chocolate, rather than milk chocolate. Some of the medical benefits include a reduction in heart disease and blood pressure.

Chocolate Today

Most of the chocolate made in factories today is used to make chocolate candy. Other chocolate goes into ice cream, chocolate drinks, and baked goods such as cakes and doughnuts. Even a sauce called **mole** (MOLE-ay), used in Mexican cooking, is made from chocolate.

Each year people around the world **consume** tons of chocolate. The people of Switzerland consume more chocolate per person than anyone else in the world. They are joined in their love of chocolate by people in many other European countries. The table below shows chocolate consumption in the top ten chocolate-consuming countries.

Top Chocolate-Consuming Countries on a Per-Person, Per-Year Basis



1	Switzerland.....	22.4 lbs.....	10.1 kg
2	Austria.....	20.1 lbs.....	9.1 kg
3	Ireland.....	19.5 lbs.....	8.8 kg
4	Germany.....	18.0 lbs.....	8.2 kg
5	Norway.....	17.9 lbs.....	8.1 kg
6	Denmark.....	17.7 lbs.....	8.0 kg
7	United Kingdom.....	17.5 lbs.....	7.9 kg
8	Belgium.....	13.2 lbs.....	6.0 kg
9	Australia.....	13.0 lbs.....	5.9 kg
10	Sweden.....	12.9 lbs.....	5.8 kg

Try This!

Yummy Chocolate Brownies

Make sure you have an adult to help you with any cutting or handling of hot foods.

1 Gather these ingredients:

- 1 cup butter or margarine
- 4 squares (1 oz. each) of unsweetened chocolate (also called baker's chocolate)
- 4 eggs
- 2 cups white sugar
- 2 teaspoons vanilla extract
- 1 1/2 cups all-purpose flour
- 1 teaspoon baking powder
- pinch of salt



2 Preheat the oven to 350°F (180°C). Rub grease over a 9x13-inch (15-cup) baking pan.

3 Melt the butter in a saucepan over medium heat on the stovetop. After the butter is melted, take it off the heat and stir in the chocolate until it is melted and mixed in. Add the eggs one at a time, stirring thoroughly. Then add the sugar and vanilla, stirring the mixture until smooth.

4 In a separate bowl, mix the flour, salt, and baking powder. Gently pour the butter, chocolate, and sugar mix into the flour and stir it until the flour is completely wet.

5 Pour the mixture into the baking pan and spread it evenly.

6 Bake for 25 to 30 minutes until the brownies begin to pull away from the sides of the pan.

7 Let the brownies cool in the pan before you cut them. Makes 12 brownies.



The next time you eat chocolate, think about how it was made.

Conclusion

It took a long time for chocolate to become popular outside the regions of Central and South America where cacao trees were first grown and used. Over the years, people added things such as sugar and milk to the long and complicated process of making chocolate from cacao beans. Today, people around the world eat millions of kilograms of chocolate, making it the world's most popular sweet.

Glossary

cacao (<i>n.</i>)	the tree from which we get chocolate (p. 5)
conching (<i>v.</i>)	powerfully mixing air into a liquid (p. 14)
consume (<i>v.</i>)	eat or buy (p. 21)
fermentation (<i>n.</i>)	a natural changing process that occurs in many foods and plants (p. 10)
ingredients (<i>n.</i>)	the different food items that go into a dish or recipe (p. 14)
machete (<i>n.</i>)	a long, thick knife (p. 8)
mills (<i>n.</i>)	machines that use animal, wind, or steam power to grind things (p. 18)
mole (<i>n.</i>)	a spicy Mexican sauce made with chile and strong chocolate (p. 20)
plantations (<i>n.</i>)	large farms with many workers (p. 6)

Index

cocoa, 13, 19	fermentation, 10
Columbus, Christopher, 16	Mayans, 16
Cortez, Hernando, 16, 17, 19	plantations, 6
Hershey, 19	pulp, 9, 12

Name _____

INSTRUCTIONS: Number the steps in making cacao beans into chocolate.

Chocolate makers get the beans in cloth bags.

The bean shells are removed.

Beans are changed in the fermentation process.

Cocoa butter is removed from liquid in molds.

The beans are dried.

Conching takes place.

The chocolate is wrapped in packages for shipping.

Nibs become liquid in the grinding process.

Cleaned beans are blended and roasted.

The pods are cut open, and the beans are scooped out.

Cocoa powder is sent to bakeries and dairies.

The bean pods are removed from the cacao tree.

Name _____

INSTRUCTIONS: Circle the simple subject and simple predicate in each sentence. Underline the complete subject once and the complete predicate twice.

1. The pods look like little footballs.
2. A skilled pod breaker cuts open the pods.
3. A worker scoops out the beans.
4. Fermentation changes the beans.
5. Hot air dries the beans.
6. Chocolate makers get the beans in large cloth bags.
7. They roast the beans to bring out the chocolate flavor.
8. Conching is the final step.
9. Molds hold the melted chocolate.
10. Candy stores sell chocolate bars.

Name _____

INSTRUCTIONS: Before reading, write what you know or think each word means. After reading the book, make a ✓ if your prediction was correct, or write the correct meaning of the word.

Word	Before Reading Predicted Meaning	After Reading Correct	After Reading Revise Meaning
mole			
ingredients			
cacao			
fermentation			
machete			
conching			
plantation			
consume			
mills			

The Hard Stuff! All About Bones

A Reading A-Z Level U Leveled Reader

Word Count: 1,961

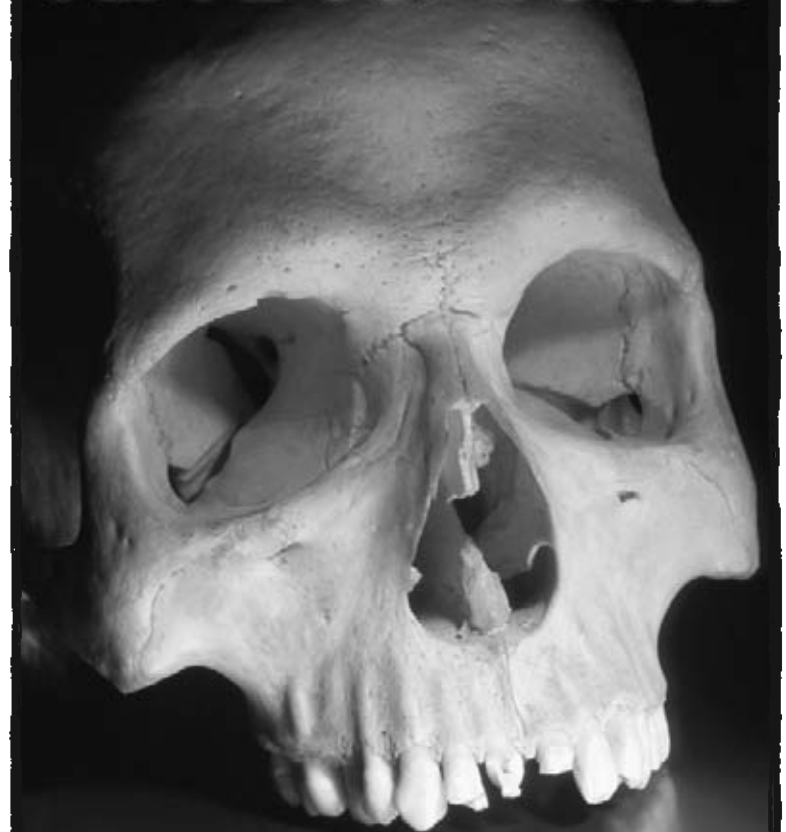


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The Hard Stuff! All About Bones



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All About Bones
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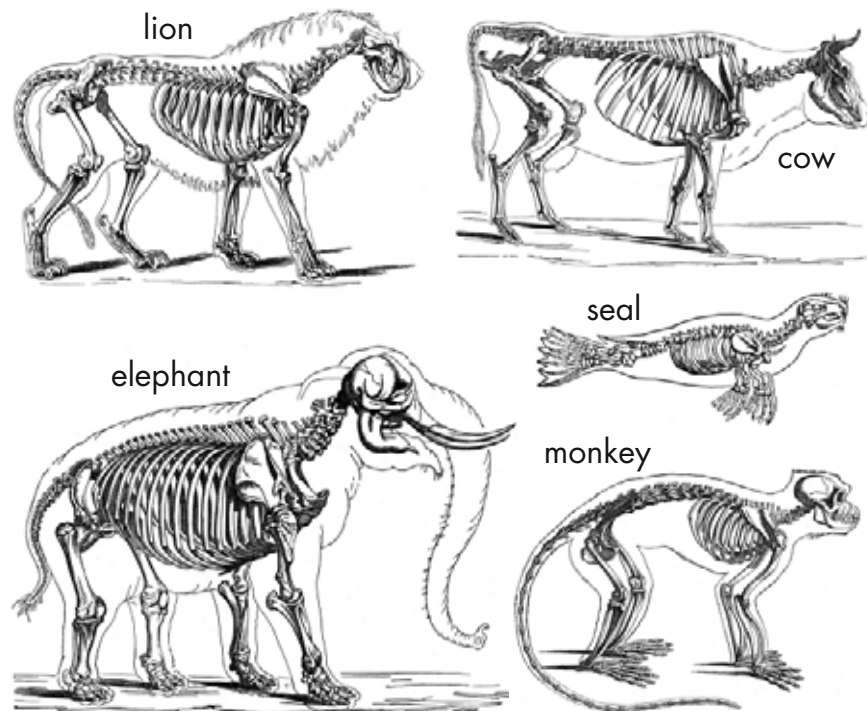
LEVEL U

Fountas & Pinnell	Q
Reading Recovery	24
DRA	40



— Table of Contents —

Body Shapers	4
Heads Up	6
Put Your Back Into It	10
And Now the Appendages	14
Don't Get Out of Joint	18
Inside Your Bones	20
Keeping Bones Healthy	21
Glossary	23
Explore More	23
Index	24



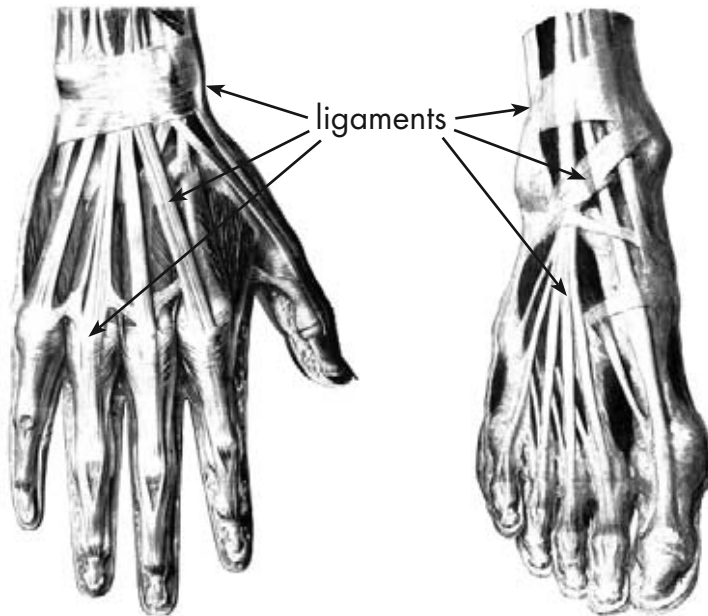
— Body Shapers —

Lizards have one. Elephants have one. Even fish in the ocean have one. You have one, too! What do you all have? You all have skeletons.

A skeleton is a collection of bones that is found inside an animal's body. The skeleton is like a frame that has muscles, blood vessels, and skin wrapped around it. Skeletons give many animals, called **vertebrates**, and all humans their shape and form. In fact, you can identify many animals just by looking at their skeletons.

The human skeleton is made up of 206 bones, starting at the top with the skull and ending at the bottom with the toe bones. Many bones have muscles attached to them by **tendons**, and these bones help us to move. Some bones protect delicate organs inside our bodies—for example, the heart and the brain. And many large bones have a special core that produces blood cells. All the bones are connected to each other with special tissues called **ligaments**, which help make up the skeleton.

To fully appreciate the function of bones, let's take a closer look at specific body areas.



These ligaments hold the hand and foot bones together.



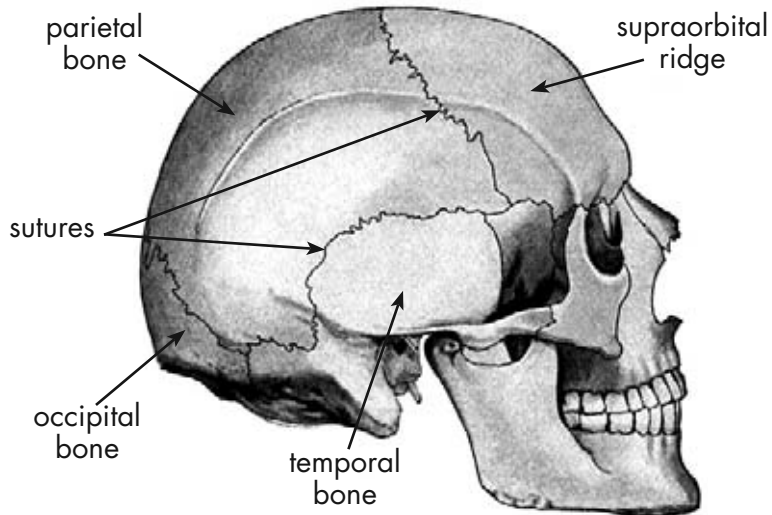
These racers wear helmets to protect their skulls.

— Heads Up —

Press your hand against your forehead—the part of your face above your eyebrows. Does your forehead feel soft, like a pillow, or does it feel hard, like a desk? Your forehead feels hard because you can feel your skull, or *cranium*, under the skin. The cranium is one set of bones in your body, and it protects your brain, which is very important and very delicate. In some ways, the cranium is like a crash helmet, except it is not as strong. That is why when you ride a bike, in-line skate, or participate in some other sports, wearing a helmet provides extra protection.

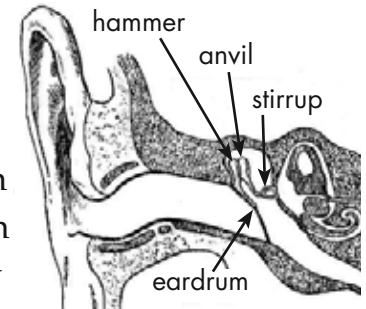
If you feel around your head, your skull appears to be all in one piece. Actually, though, the skull is made up of several different bones. The bones are held together at special joints called **sutures**. Unlike regular joints, which allow movement, the suture joints are immovable.

Remember touching your forehead? This part of the skull is the frontal bone. A more technical term for your forehead is the *supraorbital ridge*. The largest part of your skull covers the top and back of your head. This bone is called the *parietal* (pa-RI-a-tul) *bone*. The part of your skull just above your neck in the back is the *occipital* (awk-SIP-i-tul) *bone*, and the sides of the skull, above the ears, are the *temporal bones*.



A human skull

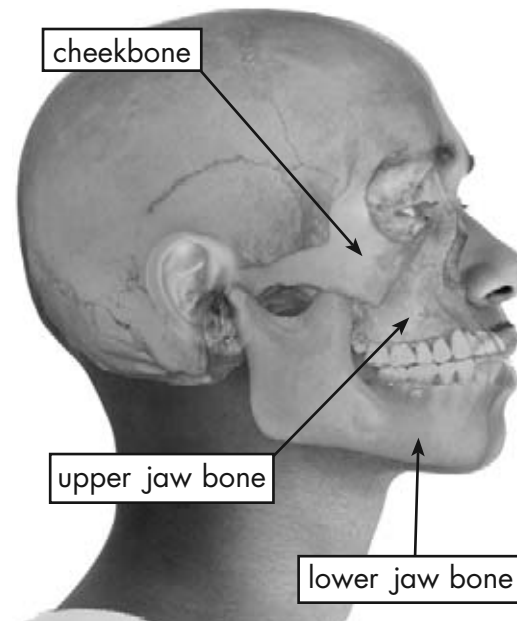
In all, your skull has 29 bones. The rest of the bones in your skull are the bones in your face, in your ears, and in your jaw. Beneath the skin on your cheek, you can probably feel your cheekbone, or the *zygomatic bone*. Your jaw is made up of two bones—the upper jaw, or *maxilla*, and the lower jaw, or *mandible*. The lower jaw is one of the only bones in your skull that can move on its own.



Bones Bonus

Your ears also have bones—the hammer, the anvil, and the stirrup, which are attached to the eardrum. These bones are not only the tiniest bones in your body, but they also are the other skull bones that can move.

When the eardrum picks up sounds and vibrates, the eardrum moves the hammer. The hammer then vibrates, which makes the anvil vibrate, which in turn pushes the stirrup bone! The brain receives the vibrations and interprets them as words, music, or other sounds.





Teeth are harder than bones.

Cartilage is softer than bones.

If you look at a skeleton, you might see something missing from the skeleton's face—a nose. Your nose is not made out of bone, but out of a tissue called **cartilage** (CAR-ti-lidg). Cartilage is more flexible than bone. Try it—touch your nose and move it around. It can bend, whereas your bones cannot. Cartilage is also found at the ends of bones to keep one hard bone from rubbing against another hard bone.

Skeletons also have teeth, but teeth are not bones. In fact, teeth are harder than bones. The outside of a tooth is made of a substance called enamel. It is the hardest substance in the body.

Put Your Back Into It

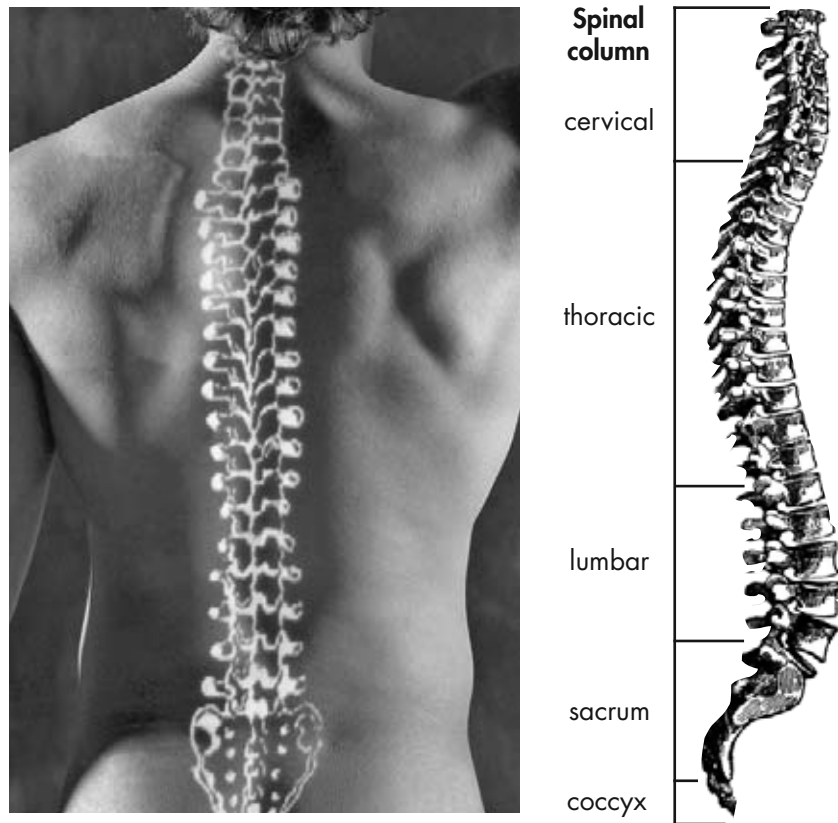
The skull connects to a major system of bones—the spinal column, also called the backbone. You can feel the first few parts of the spinal column at the back of your neck. These ridges continue down your back, all the way to your hips. These ridges are the individual bones of your backbone, and they are called *vertebrae* (VER-te-bray).

The backbone has 33 vertebrae in all. Seven vertebrae are found in the neck, and they are called the *cervical* vertebrae. Twelve vertebrae run from the top of your back to about the middle of your back, and they are called the *thoracic* (the-RA-sik) or *dorsal* vertebrae. Five *lumbar* vertebrae are found at the small of your back, followed by five *sacral* vertebrae, which sit between your hips. The remaining vertebrae form the *coccyx* (KOK-sicks) bone at the bottom of your spinal column.



Bones Bonus

The top two vertebrae are called the *atlas* and the *axis*. These two vertebrae allow you to nod and shake your head.

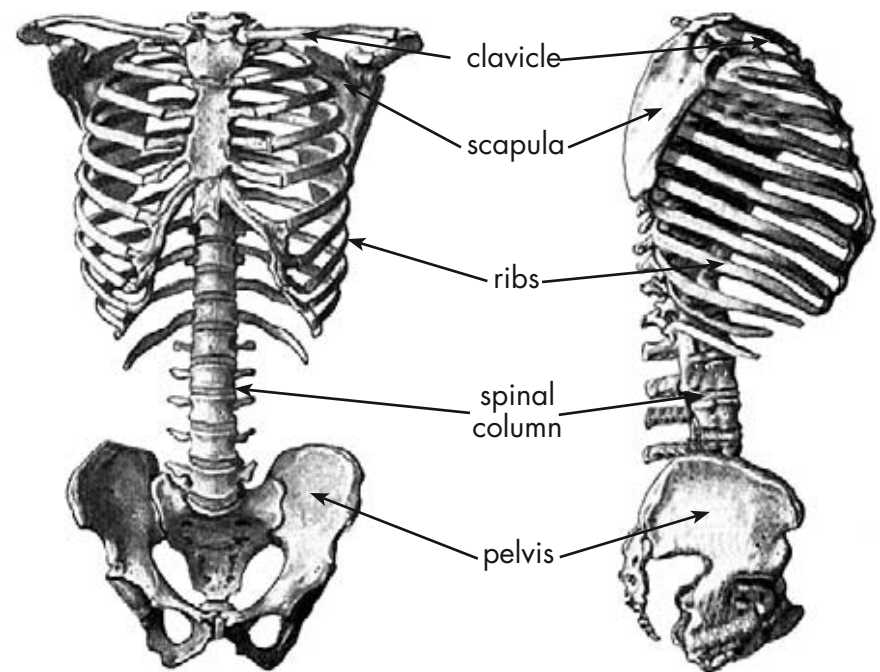


Your spinal column has two very important functions. First, the spinal column protects the delicate **spinal cord**, which runs through the vertebrae. The spinal cord is the place where all the nerves in your body meet to transmit information to your brain.

The second function is that the spinal column allows you to bend and twist, roll and flip. Because the backbone is a chain of bones, not one solid bone, it is very flexible.

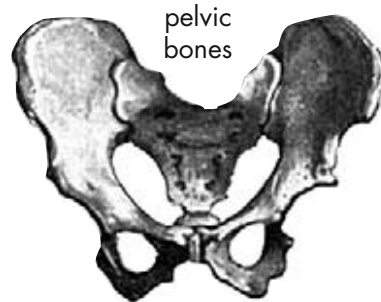
The skull is not the only bone attached to the backbone; the shoulder bones, ribs, and pelvic bones are attached to it, too.

Along with giving shape to your torso, the ribs serve a very important purpose—to protect the lungs and heart. The lungs and heart lie inside the ribs, which form the rib cage. So if you bang your torso, your lungs and heart don't get squashed because the ribs provide a sturdy wall around them. Your rib cage has 12 bones on each side, and each of those bones is connected to one of the 12 dorsal vertebrae.



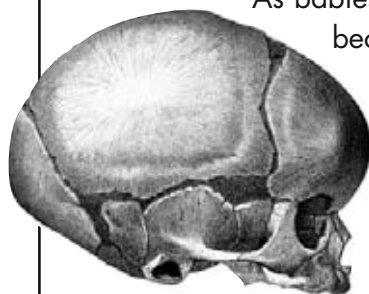
At the top end of the spinal column, you will also find the *scapula* and the *clavicle*. Scapula is the technical term for the shoulder blade, and clavicle is the technical term for the collarbone. The scapula and the clavicle make up the shoulder.

Near the bottom of the backbone is the hip bone, or *pelvic bone*. On each side, the pelvic bone looks like a shallow dish or bowl. That's because in this area of the body lie your intestines and other lower-body organs.



Boning Up

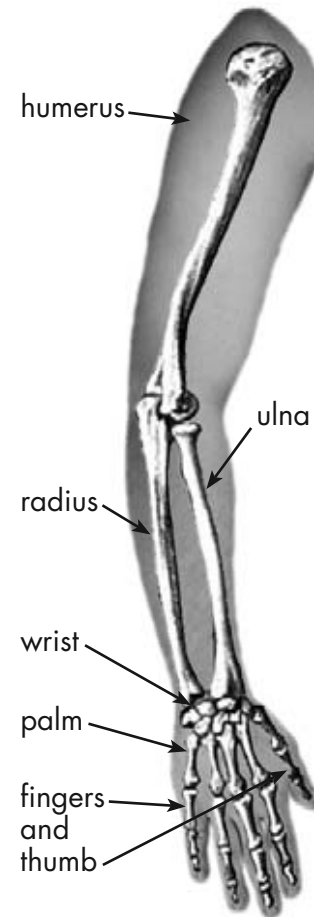
The skeleton of a newborn baby is not the same as an adult's skeleton. An unborn baby has cartilage instead of bones. As the unborn baby grows and develops, the cartilage hardens and turns to bone. By the time the baby is born, most of the cartilage has hardened and turned to bone.



As babies become children and children become adults, their bones continue to harden or even join together. One of the last sets of bones to join together is the group that makes up the pelvis. These bones become one solid structure when a person is in his or her late teens or early 20s.

And Now the Appendages

Your hands and arms, feet and legs, are your **appendages**, and they enable you to do many different activities. Your hands and arms enable you to lift and hold things, while your feet and legs help you to move. Being able to do these actions is partially possible because of the bones inside your appendages.



Your arms are made up of three bones each—the *humerus*, the *ulna*, and the *radius*. The humerus is the upper arm bone, and it is attached at the top to the shoulder. The ulna and the radius make up the lower part of the arm, between the wrist and the elbow.



These kids use their arms to help hold themselves up.

Many for Manipulating

Your fingers may be smaller than your arms, but they have more bones. Here's how the numbers of bones in each part of your hands and arms compare.

Arm: 3	Each thumb: 2
Wrist (<i>carpus</i>): 8	Fingers and thumbs
Palm (<i>metacarpus</i>): 5	(<i>phalanges</i>): 14
Each finger: 3	



Your hand, including your wrist, is full of bones. In fact, your hand and wrist together have more bones than any other part of your body—27! That's 54 bones total for both hands. Because hands and wrists have so many bones, they are very flexible and **dexterous**, and we can do small, precise activities, such as writing and drawing, playing the piano, and tying shoelaces.

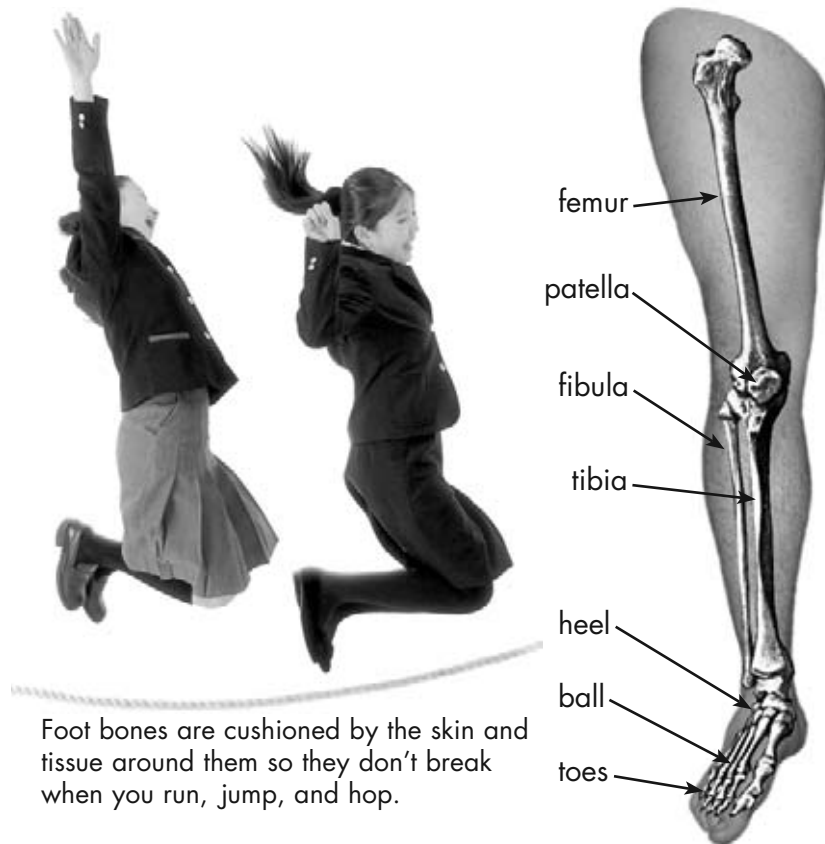
The structure of the legs and feet is comparable to the structure of the arms and hands. The top portion of the leg is one solid bone, called the thighbone, or *femur*. The bottom part of the leg comes in two parts—the shinbone, or *tibia*, and the *fibula*. Between the upper and lower parts of the leg is one more bone—the kneecap, or *patella*. The kneecap lies over the knee joint and protects the tendons beneath that allow the leg to bend.

Bones Bonus

The longest, strongest, and largest bone in your body is in your leg. It's the thighbone, or femur. It extends from the pelvis to the knee. To break the femur requires a lot of force. For example, you would have to fall from a great height or have a high-speed collision while skiing or skating.



Leg bones help us move in many ways.



Like a hand, the foot is a complex system of many bones. Each foot has only one less bone than a hand—26—for a total of 52 bones for both feet. The heel of a foot has seven *tarsal* bones, and the ball of a foot has five *metatarsal* bones. Like the hand, the foot has 14 *phalange* bones—two for the big toe and three each for the remaining toes. Skin and tissue on the bottoms, or soles, of the feet protect the bones from the impact of jumping and running.

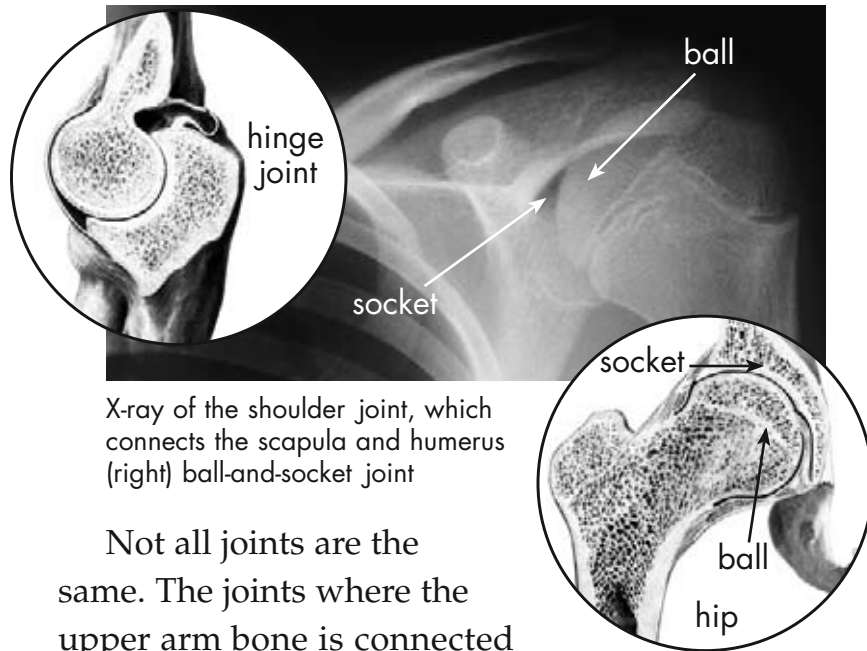
🦴 Don't Get Out of Joint 🦴

Along with over 206 bones, the human body has over 100 joints. Joints are the places where bones meet. Bones are hard and unbending, but because bones are connected at joints, our bodies can bend and twist.



Bones Bonus

Sometimes we say that people are double-jointed, but this doesn't mean that they have two joints instead of one. Double-jointed people are more flexible than the average person because the ligaments between the joints are looser. These loose ligaments enable them to bend in unusual ways.



X-ray of the shoulder joint, which connects the scapula and humerus (right) ball-and-socket joint

Not all joints are the same. The joints where the upper arm bone is connected to the shoulder bone and where the upper leg bone is connected to the hipbone are **ball-and-socket** joints. The top ends of the humerus and the femur have a ball shape. These balls fit snugly into a round socket in the shoulder and hipbone respectively.

The knee joint and the elbow joint are examples of **hinge** joints. Here, the joints can only bend in one direction. The joints between the vertebrae of your spine are called **swivel** joints, which enable the body to tilt and turn. And the last type of joint is a suture joint, like those found on the skull. These joints connect bones but do not allow any movement.

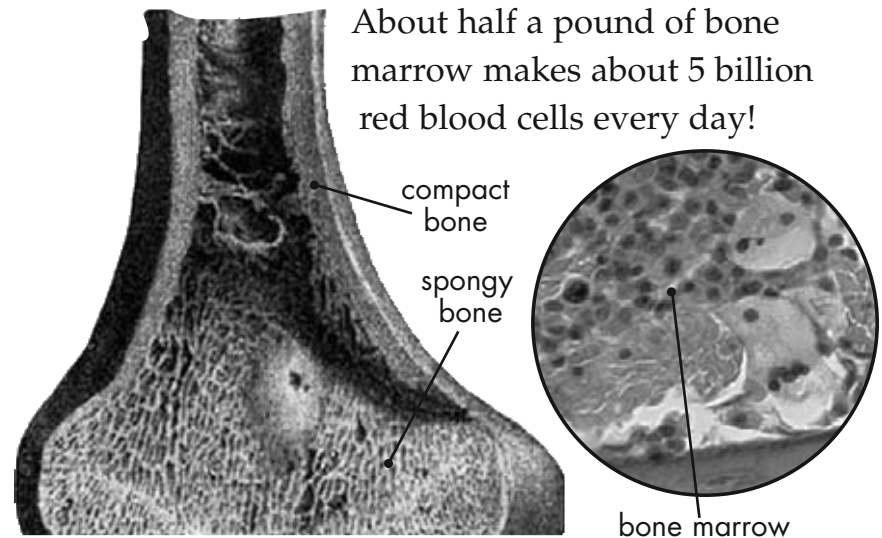
Inside Your Bones

It might seem as if a bone is nothing more than a hard, solid object, like a rock, but that couldn't be further from the truth. Bones are definitely alive with thousands of bone cells that need oxygen and food to survive, just like other types of cells.

On the outside, a bone is hard and solid. This outer layer is called the compact bone. Below the compact bone is the spongy bone, which has holes to keep the bones light in weight so our muscles can lift them.

Below the spongy bone and also within it is the **bone marrow**. The bone marrow is important because it is where the body makes blood cells.

About half a pound of bone marrow makes about 5 billion red blood cells every day!



Keeping Bones Healthy

Even though bones are very strong, they can break if they are struck with enough force. Broken bones can be fixed with a little help from a doctor and a lot of help from bone cells.

In order for a bone to heal properly, the bone must be put back together exactly the way it was before the break. Depending on how severe the break is, doctors may need to move around the broken bones to put them back together. A cast is then placed around the body part where the bone was broken. The cast prevents the body part from moving so the bone has time to heal. As soon as the bone broke, the bone cells immediately began repairing it. Holding the broken bone in place with a cast lets the bone cells do their job.



A cast helps hold broken bones in place so they can heal.



Bones help you do all kinds of fun activities.

Bones need to remain healthy in order for them to remain strong. Eating a well-balanced diet ensures not only that the bones will continue to be strong, but also that they will continue to produce healthy blood cells in the bone marrow. Foods rich in **calcium phosphate** are especially important. Dairy products like milk have calcium, which is why doctors often suggest that people drink milk. Exercise also keeps your bones in good working order.

Your bones give your body its shape, but they also give you much more. They give you the ability to move, to sit, to stand, and to write. You wouldn't be you without your bones!

Glossary

appendages	arms and legs (p. 14)
ball-and-socket	joints that fit together like a ball fits into a glove (p. 19)
bone marrow	material in large bones that creates red blood cells (p. 20)
calcium phosphate	a mineral that helps keep bones strong (p. 22)
cartilage	a tough, rubbery substance found at the end of bones or in the nose (p. 9)
dexterous	able to make precise movements (p. 15)
hinge	joints that open like a door (p. 19)
ligaments	tissues that connect one bone to another bone (p. 5)
spinal cord	collection of nerves protected by vertebrae (p. 11)
sutures	joints or seams between skull bones (p. 7)
swivel	tilt or turn (p. 19)
tendons	tissue that attaches muscles to bones (p. 5)
vertebrates	animals with an interior skeleton (p. 4)

Explore More

On the Internet, use *www.google.com* to find out more about topics presented in this book. Use terms from the text, or try searching for glossary or index words.

Some searches to try: *skeletal system*, *bone marrow*, or *spinal column*.

Index

arm, 14, 15	joint, 7, 16, 18
humerus, 14, 19	ball-and-socket, 19
radius, 14	hinge, 19
ulna, 14	suture, 7, 19
bone cells, 20, 21	swivel, 19
bone marrow, 20, 22	legs, 16
brain, 6, 8, 11	femur, 16-19
broken bones, 21	fibula, 16, 17
cartilage, 9, 13	patella (knee), 16
clavicle (collarbone), 12, 13	tibia, 16, 17
cranium (skull), 5-8, 10, 12, 19	nerves, 11
occipital bone, 7	nose, 9
parietal bone, 7	pelvic bone (hip), 12, 13, 18, 19
supraorbital ridge, 7	pelvis, 12, 13, 16
temporal bones, 7	red blood cells, 20, 22
ear, 8	rib cage, 12
anvil, 8	scapula (shoulder), 12, 18
hammer, 8	spinal column
stirrup, 8	(backbone), 10-12, 19
fingers, 14, 15	vertebrae, 10, 19
foot, 17	atlas, 10
hand, 15	axis, 10
jaw, 8	cervical, 10
mandible, 8	coccyx, 10
maxilla, 8	lumbar, 10
zygomatic bone, 8	sacral, 10
	thoracic (dorsal), 10, 12
	wrist, 14, 15

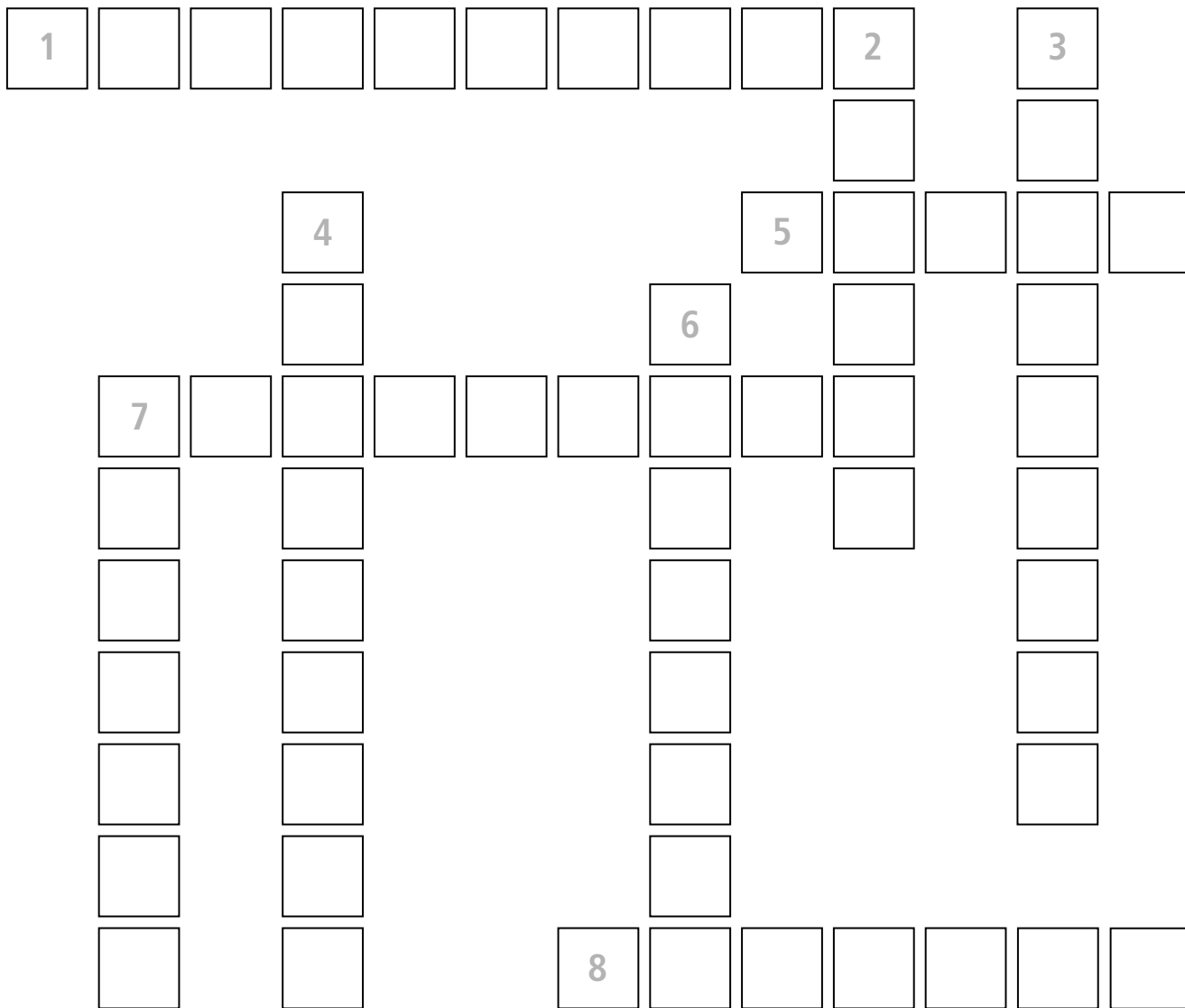
Name _____

INSTRUCTIONS: In the table below, write the important details from each chapter of *The Hard Stuff! All About Bones* that support the main idea.

Main Idea	
There are many different kinds of bones, which have different functions, in our bodies.	
Chapter	Important Details
Heads Up	
Put Your Back Into It	
And Now the Appendages	
Don't Get Out of Joint	
Inside Your Bones	
Keeping Bones Healthy	

Name _____

INSTRUCTIONS: Use the clues to complete the crossword puzzle. Challenge yourself to think of the word without having to check the book.



ACROSS

1. Arms and legs
5. Joints that open like a door
7. Tough, rubbery substance found at the end of bones
8. Tissues that attach muscle to bone

DOWN

2. Joints that allow tilting and turning
3. Tissues that connect one bone to another bone
4. The individual bones in the backbone
6. The lower jaw
7. The skull

Get Moving! All About Muscles

A Reading A-Z Level U Leveled Reader

Word Count: 2,002

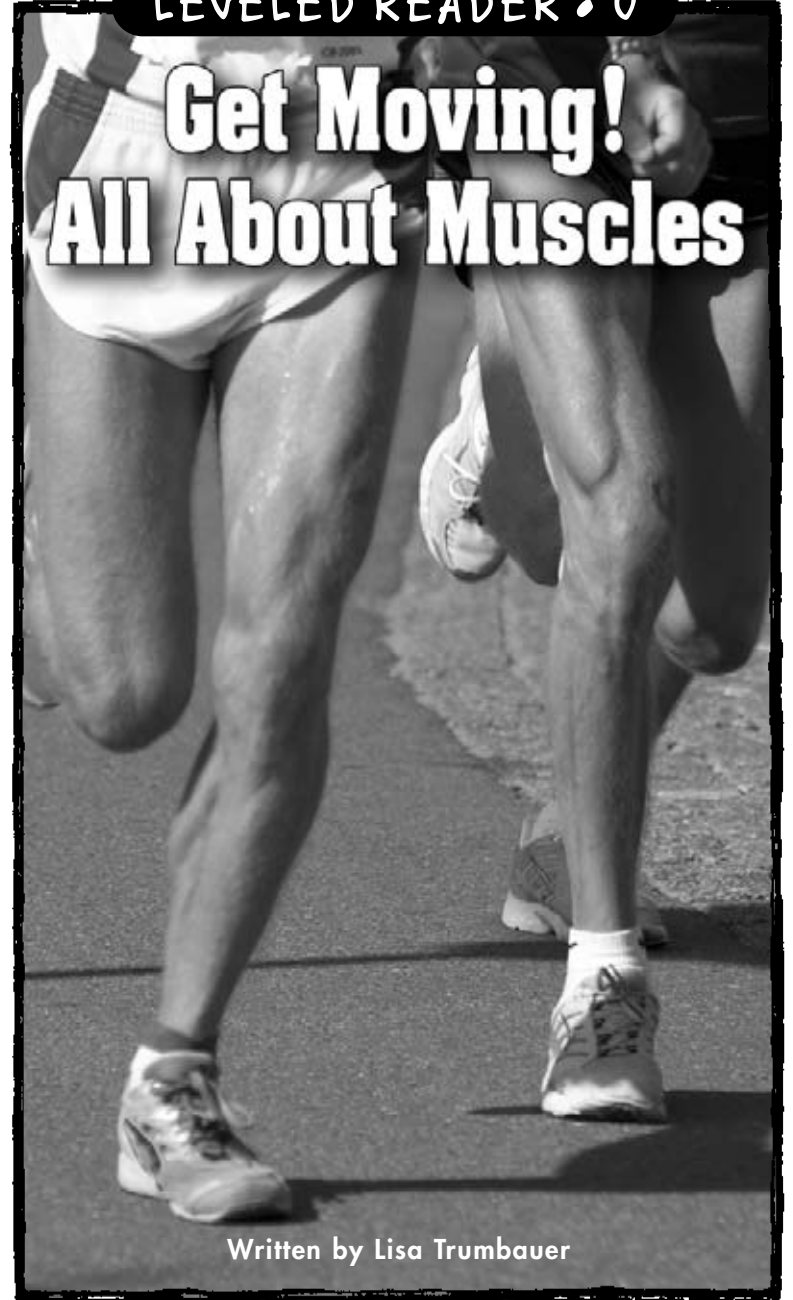


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Get Moving! All About Muscles



Written by Lisa Trumbauer

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Get Moving! All About Muscles



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Correlation

LEVEL U

Fountas & Pinnell	Q
Reading Recovery	24
DRA	40



Table of Contents

A Moving Machine	4
Muscle Monster	6
Make a Muscle—the Skeletal Muscles	8
Mirror, Mirror	12
Don't Think About It—the Smooth Muscles	14
One More—the Cardiac Muscle	16
A Closer Look	18
Muscle Building	20
Conclusion	22
Glossary	23
Index	24

A Moving Machine

Have you ever walked by a gym and watched people lifting weights? Maybe you even have weight training in school. Running, bending, twisting—these are all forms of training your body and “shaping up.” But what, exactly, are you



This woman lifts weights to keep her arm muscles in shape.

training? What are you shaping? What is all this lifting and grunting and straining about? It's about your muscles.

Muscles are the part of the body that allows you to move. If you didn't have muscles, you wouldn't be able to lift or jump or walk, or even write or smile or chew. Your muscles make your body a moving

machine. Shaping up, or getting into shape, means shaping your muscles so they are strong and powerful. Strong, powerful muscles make your body move more efficiently.

The human body is loaded with muscles of many different sizes—more than 600 muscles in all. Although all muscles help your body move, muscles are divided into three main types: the skeletal muscles, the smooth muscles, and the cardiac muscle. Two of these muscle types—the smooth muscles and the cardiac muscle—are **involuntary muscles**. That means that they move on their own, without us telling them to move. Skeletal muscles, on the other hand, are voluntary, which means they move because we want them to. Most of the muscles in your body are skeletal muscles.

So let's get moving, and see what the skeletal muscles are all about.

A Muscle Minute

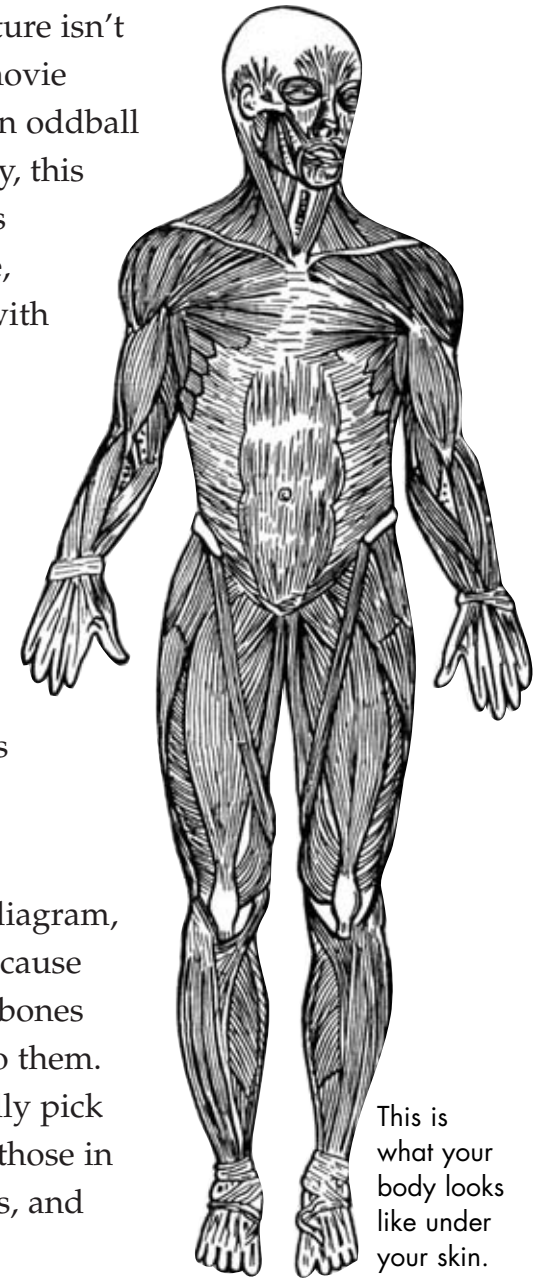
You're getting ready to turn the page, aren't you? As you do, think of all the muscles you use just to do this one small task. Muscles lift your arm, and muscles move your hand and fingers, which enable you to flip the page. You could say that muscles made you do it!



Muscle Monster

This scary creature isn't the latest creepy movie monster, or even an oddball superhero. Actually, this creature is you. It's what you look like, under your skin, with all your skeletal muscles in place. The dark, stringy-looking things are the muscles, and the whitish parts are the tendons. Tendons are fibers that attach muscles to bones.

You can't see any bones in this diagram, can you? That's because muscles cover the bones and are attached to them. The muscles literally pick up the bones, like those in your arms and legs, and make them move.



This is what your body looks like under your skin.

Here's how these muscles work. If you want to move, you form the thought in your brain. Your brain then sends a signal to the muscles needed to make the movement you are thinking about. You might wiggle your toes, or snap your fingers, or even lift your eyebrows.

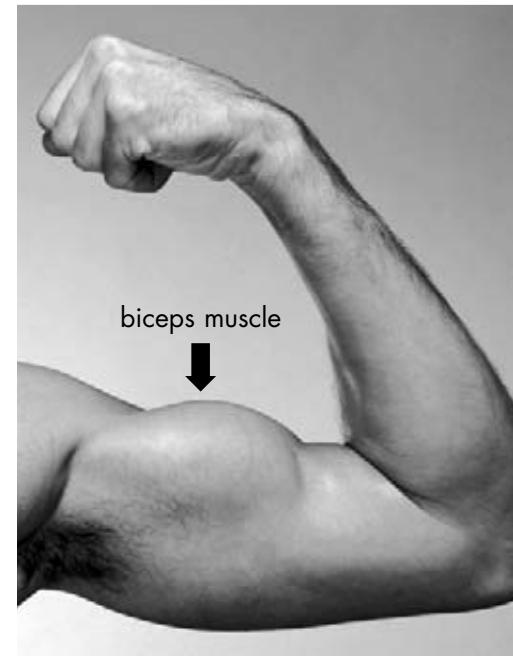
Once the signal reaches the muscles, your muscles begin to move. Each muscle pulls on the bone to which it is attached, and this pulling puts your body in motion. Because your brain must tell these muscles to move, these movements are voluntary. The voluntary muscles are your skeletal muscles.



Your brain tells your leg muscles to kick a ball.

Make a Muscle—the Skeletal Muscles

Have you ever asked anyone to “feel your muscle”? What did you do? You probably made a fist, lifted your forearm toward your shoulder, and pointed to the bulge that formed on your upper arm. Good job! You’ve just provided a good example of how muscles work.



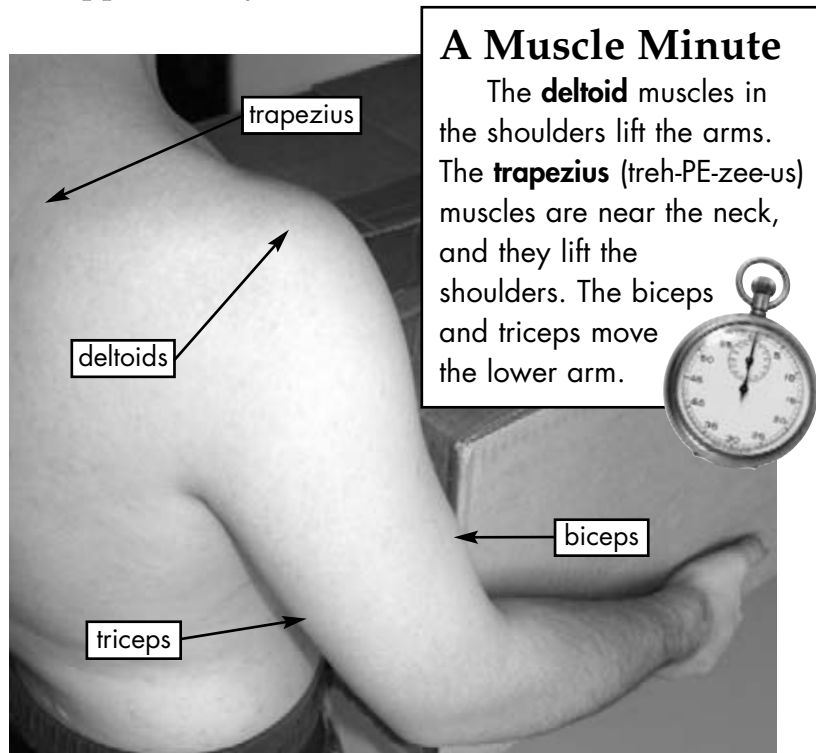
The biceps muscle contracts to pull up the forearm.

When you pulled your arm upward, the muscle in your upper arm, the biceps, contracted. It pulled on the bone, causing your forearm to lift. You can feel the contracted biceps muscle bulging under your skin.

Although muscles allow us to do all kinds of movements, pulling is the only movement that muscles themselves can do.

In order for you to lower your arm, another muscle must get into action. This muscle is the triceps muscle, and it lies on the underside of your upper arm. When you lower your arm, the biceps muscle relaxes, and the triceps muscle contracts—it pulls your forearm down.

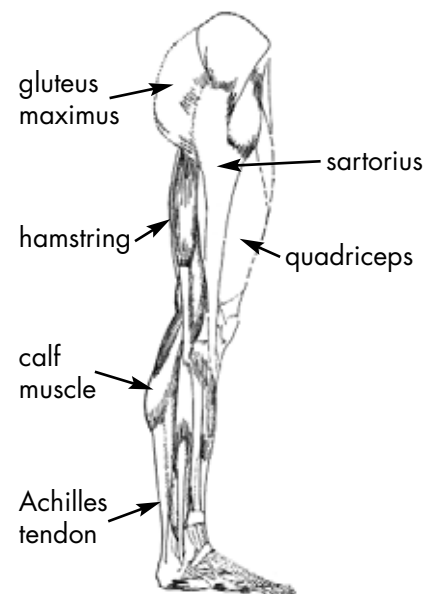
In most cases, therefore, your muscles must work as a team. One muscle pulls, or contracts, so that you can move in one way; then another muscle must pull, or contract, so your body can move in the opposite way.



Muscles work as a team so this man can lift the box.

Muscles in your legs move your legs in a similar way as the muscles in your arms. Try this: sit down, stretch out your leg, and feel the top of your thigh. The muscle you feel here is the **quadriceps** (KWAD-ri-seps), which enables you to lift your leg. If you bend your knee toward you, you might feel a muscle on the back of your thigh. This is the **hamstring**, which makes your knee bend.

A big muscle bulges on your lower leg, at the back. You might call this your calf muscle, but its more scientific name is the **gastrocnemius** (gas-trahk-NE-mee-us). Stand up, and lift your foot behind you. This is the function of the calf muscle—to pull up the heel of your foot.



Runners use their leg muscles.



The sartorius muscle allows this runner's knee to bend so she can stretch her leg muscles.

Run your hand down from the back of your calf to the top of your heel. Do you feel that flexible part, just above your ankle? This is actually a tendon, called the **Achilles** (eh-KIL-eez) **tendon**. It is your body's longest and strongest tendon, connecting your calf muscle to the bone in your heel.

A few other important muscles are found in your legs, such as the **sartorius** (sahr-TO-reeus). It is your body's longest muscle, and it is responsible for allowing your leg to twist and bend at the

knee. Then there's the biggest muscle of all—the **gluteus maximus**

(GLEWT-ee-us MAK-seh-mus).

This is the muscle that you feel in your butt.



A Muscle Minute

Achilles was a warrior in Greek myth whose only weak spot was his heel. The tendon that connects the calf muscle to the heel bone is called the Achilles tendon after him.

Mirror, Mirror

Take a look at yourself in the mirror, and make a bunch of funny faces. Wiggle your eyebrows, move your lips, blink your eyes. How is your face able to make all these expressions? Once again, your skeletal muscles made you do it.

In fact, the muscles of your eye are the most active muscles in your body. Scientists think that these muscles move more than 100,000 times a day.

The skull is the bone that makes up most of your head, and it is largely covered with muscles. Only one bone on your face actually moves—your jaw, or the mandible (MAN-deh-behl). Only two muscles on your face are needed to raise and lower your jaw. The **temporalis** is connected to your temple, and the **masseter** (ma-SEET-her) is connected to your cheekbone.



Your jaw muscles help you bite and chew food.

So what do the other muscles on your face move? They move other muscles, which are attached to the skull. As the muscles move under your skin, your face shows different expressions.

For example, some muscles of your face help you to smile and frown. Muscles that help you smile are attached to your cheekbone on one end and to your lips on the other. When the muscles contract, your lips move up. Other muscles are attached to the chin and the lips. These muscles pull your lips down into a frown.



This man is a champion of making his face muscles move in unusual ways.

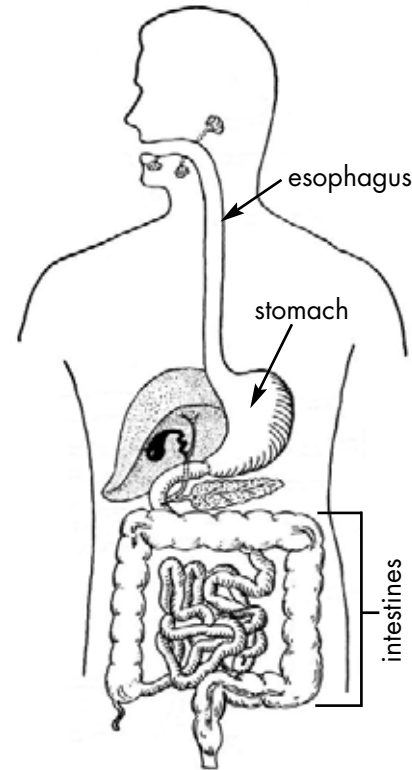
A Muscle Minute

How many muscles are needed to make you smile? 17! That's nothing, though, compared to how many muscles are needed to form a frown—40! That's more than double the amount needed to smile. So it really does take less effort to smile than to frown.



Don't Think About It—the Smooth Muscles

Every time you eat, you set a variety of muscles into motion. A few of those muscles are skeletal, because they move your jaw up and down. Other



muscles move inside your body to help move food through your system. These muscles move without any instructions from you. Moving all on their own, or involuntarily, these muscles are called smooth muscles.

Involuntary muscles keep your food moving through your body.

Smooth muscles are generally smaller and thinner than skeletal muscles. They are responsible for the small ways in which the organs inside your body move. Smooth muscles push food to your stomach; then smooth muscles push food from your stomach into your intestines. Eventually, smooth muscles push the unused food out of your body.

Smooth muscles are generally smaller and thinner than skeletal muscles. They are responsible for the

Blood vessels also have smooth muscles, and these muscles are found inside the vessels' walls. These smooth muscles help push blood through the vessels and ultimately through your body.

Smooth muscles are also important for breathing. Once the air enters your body, smooth muscles push the air downward and into your lungs. Without smooth muscles, you wouldn't be able to breathe, your blood would not be able to flow, and your food would not pass into your stomach and out again.

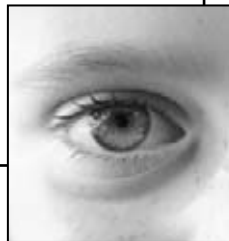
Try This

The Eyes Have It

Another important smooth muscle is in your eye. The black part of your eye is called the pupil. It gets bigger when you are in the dark to let in more light, and it gets smaller when you are in the light to limit the light. How does the pupil get bigger and smaller? Muscles pull the pupil open and closed.

What you need: A flashlight, mirror, and dark room.

1. Put your face close to the mirror. Look into the mirror with the flashlight off. See how large your pupils are.
2. Turn on the flashlight. Shine the light toward your eyes, but not directly in them, and watch your pupils get smaller.



One More—the Cardiac Muscle

Your body has one more type of muscle, and it is the only one of its kind. It is the cardiac muscle, or your heart. Like the smooth muscles, your heart muscle is always in motion, even though you



Doctors hold a human heart during surgery.

haven't asked it to do anything. It is an involuntary muscle, pumping and pushing blood through your body, every minute, every second, of every day.

Your heart keeps your body running smoothly by pumping blood throughout your body.

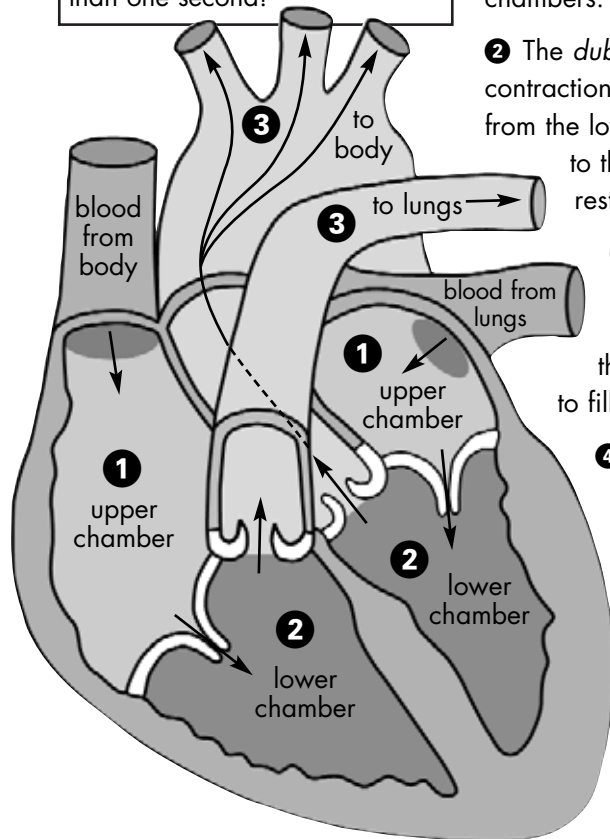
The heart has openings that control the flow of blood moving through it. These openings, called valves, are controlled by smooth muscles, which open and close the valves. In fact, the shutting of the valves is the sound of your heart beating. When smooth muscles inside your heart contract, blood moves from one section of the heart to the other.

Your heart might not be the biggest muscle in your body, but it is definitely the most important.

How the Cardiac Muscle Works

When doctors listen to your heart they hear your cardiac muscle contracting. The sound it makes is *lub-dub*. The *lub* is the cardiac muscle contracting the upper chambers of the heart. The *dub* is the cardiac muscle contracting the lower chambers of the heart.

The average adult heart beats 72 times per minute. One beat is one *lub-dub*. That means each *lub-dub* and rest happens in less than one second!



- ❶ The *lub*, or first contraction, pushes blood from the upper chambers of the heart to the lower chambers.
- ❷ The *dub*, or second contraction, pushes the blood from the lower chambers out to the lungs and the rest of your body.
- ❸ Then the cardiac muscle rests, which allows the upper chambers to fill with blood again.
- ❹ The next *lub-dub*, or pair of contractions, happens without you having to think about it.

A Closer Look

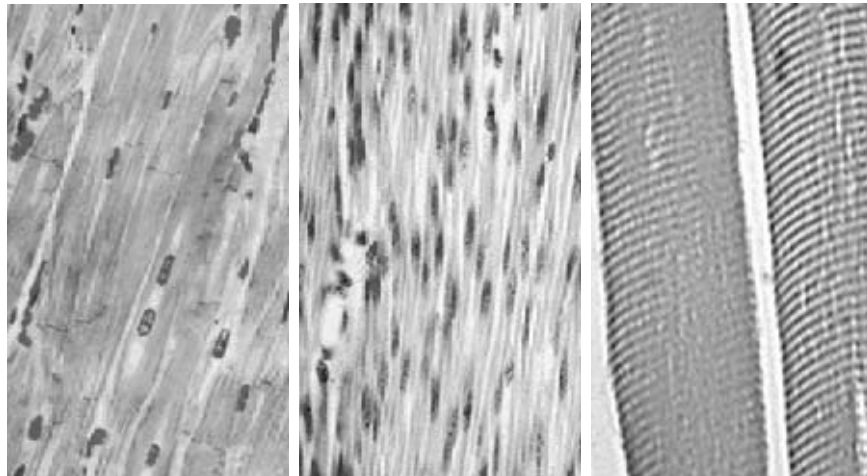
You've probably noticed that skeletal muscles appear to be dark and rather stringy. Muscles are made up of special cells called fibers, and the fibers are, indeed, very long. In addition, each muscle fiber is made up of smaller fibers, called **myofibril**. Long muscle fibers are bound together in groups called **fascicles**. All the fascicles are held together by tissues, and the fascicles and tissues make up one strand of muscle. So one muscle can have several thousand fibers, and many more myofibrils.

Protein Power

Your skeletal muscles are also made up of protein. Eating protein replenishes the protein in your muscles, keeping your muscles strong. So where do you get protein? You get it from meat, such as fish or chicken, or from plants, such as spinach, bean products, seeds, pasta, and seaweed.



Eating protein helps your muscles.



Cardiac
muscle cells

Smooth
muscle cells

Skeletal
muscle cells

A Muscle Minute

The smallest muscle in your body is a smooth muscle, and it is in your ear. It is called the **stapedius**, and it controls the movement of a bone in your ear. You would need a microscope to see this muscle—it is only 0.01 inches (0.0254 cm) long.



If you compare the three types of muscles under a microscope, you can see other ways in which skeletal, smooth, and cardiac muscles differ. The cells of the skeletal muscles appear separate and straight. Smooth-muscle cells are also straight, but they are more firmly connected. The cells of the cardiac muscle, or the heart, are more wavy and branching.



Different ways to exercise your skeletal muscles

Muscle Building

Your smooth muscles and your cardiac muscle are constantly moving, so you don't need to exercise them. Your skeletal muscles, however, need you to take care of them. Your muscles adjust to the way your body uses them. If you use your muscles a lot, your muscles remain strong and may even become stronger. Health experts tell us to exercise to keep our muscles working properly.

Muscles also become tired. Unlike your smooth and cardiac muscles, which never rest, your skeletal muscles do need to rest. It takes a lot of oxygen to keep these muscles moving. Rest helps the muscles regain their strength.

However, when you are not very active, your muscles are not active. Slowly, they adjust to being inactive, becoming weaker and weaker. Weak muscles don't allow you to do as many activities; for example, you won't be able to run very far or for very long, and you won't be able to lift heavy objects.

That's where "bodybuilding" comes in. Bodybuilding is really muscle building. People "build" their bodies by making their muscles bigger and stronger. As they lift weights, their muscles adjust to the activity and become more powerful, so more and more weight can be lifted each time. At first, the muscles will not be able to lift very heavy loads. Over time and with constant training, the muscles build and become strong.

Bodybuilders lift weights to build muscles.



Sometimes people can actually stretch their muscles too far. When this happens, a doctor will say they have "pulled a muscle." Often when a muscle has been pulled, some muscle fibers have torn. The muscle usually hurts, and it might even feel a little tight. Rest will help the muscle to heal and rebuild its broken fibers.

Muscles also weaken if you break a bone. Broken bones are healed by preventing the bones from moving. If the bones don't move, then the muscles don't move either. When a cast comes off, the broken bone will be stronger, but the muscles will be weak. Doing slow, moderate exercise will strengthen the weakened muscles.

Conclusion

Your body is a muscle machine. To keep your muscles working, the muscles need to remain active. Doctors stress the importance of exercise for keeping muscles strong, and they're right. Exercise not only strengthens your skeletal muscles, but it keeps your heart pumping and your blood flowing.

Your muscles react to the messages you send to your brain. Tell your muscles to move, and they will. Exercise your muscles daily, and they'll work more efficiently.

So go on—get moving, and mind your muscles!

Glossary

Achilles tendon	a tendon that connects the calf muscle to the heel bone (p. 11)
deltoid	shoulder muscle that lifts arm (p. 9)
fascicles	groups of long muscle fibers (p. 18)
gastrocnemius	calf muscle that lifts the heel (p. 10)
gluteus maximus	muscle in butt and upper thigh that helps move legs forward (p. 11)
hamstring	muscle on back of thigh that makes the knee bend (p. 10)
involuntary muscles	muscles that move without you having to tell them to (p. 5)
masseter	muscle connected to cheekbone that helps raise and lower the jaw (p. 12)
myofibril	small fibers that make up muscle fibers (p. 18)
quadriceps	muscle on top of thigh that lifts the leg (p. 10)
sartorius	muscle that allows leg to twist and bend at knee (p. 11)
stapedius	muscle that controls the bones in the ear (p. 19)
temporalis	muscle connected to temple that helps raise and lower the jaw (p. 12)
trapezius	neck muscle that lifts the shoulder (p. 9)
voluntary muscles	muscles that move when you tell them to (p. 7)

Index

Achilles tendon, 10, 11	leg(s), 6, 10, 11
arm(s), 5, 6, 8, 9	gastrocnemius, 10
biceps, 8, 9	gluteus maximus, 10, 11
triceps, 9	hamstring, 10
blood vessels, 15	quadriceps, 10
bodybuilding, 21	sartorius, 10, 11
bone(s), 6, 8, 22	lungs, 15
brain, 7, 22	oxygen, 20
contract(s), 8, 9, 13, 17	protein, 18
ear, 19	pulled, 22
exercise, 20, 22	relax(es), 9
eye, 12, 15	shaping up, 4
face, 12, 13	shoulder, 9
fibers, 6, 18, 22	deltoid, 9
fascicles, 18	trapezius, 9
myofibril, 18	stomach, 14
heart, 16, 17, 22	tendon(s), 6, 11
jaw, 12, 14	types of muscle
masseter, 12	cardiac, 5, 16, 19, 20
temporalis, 12	involuntary, 5, 14, 16
	skeletal, 5–8, 12, 14, 18–20
	smooth, 5, 14–16, 19, 20
	voluntary, 5, 7



Name _____

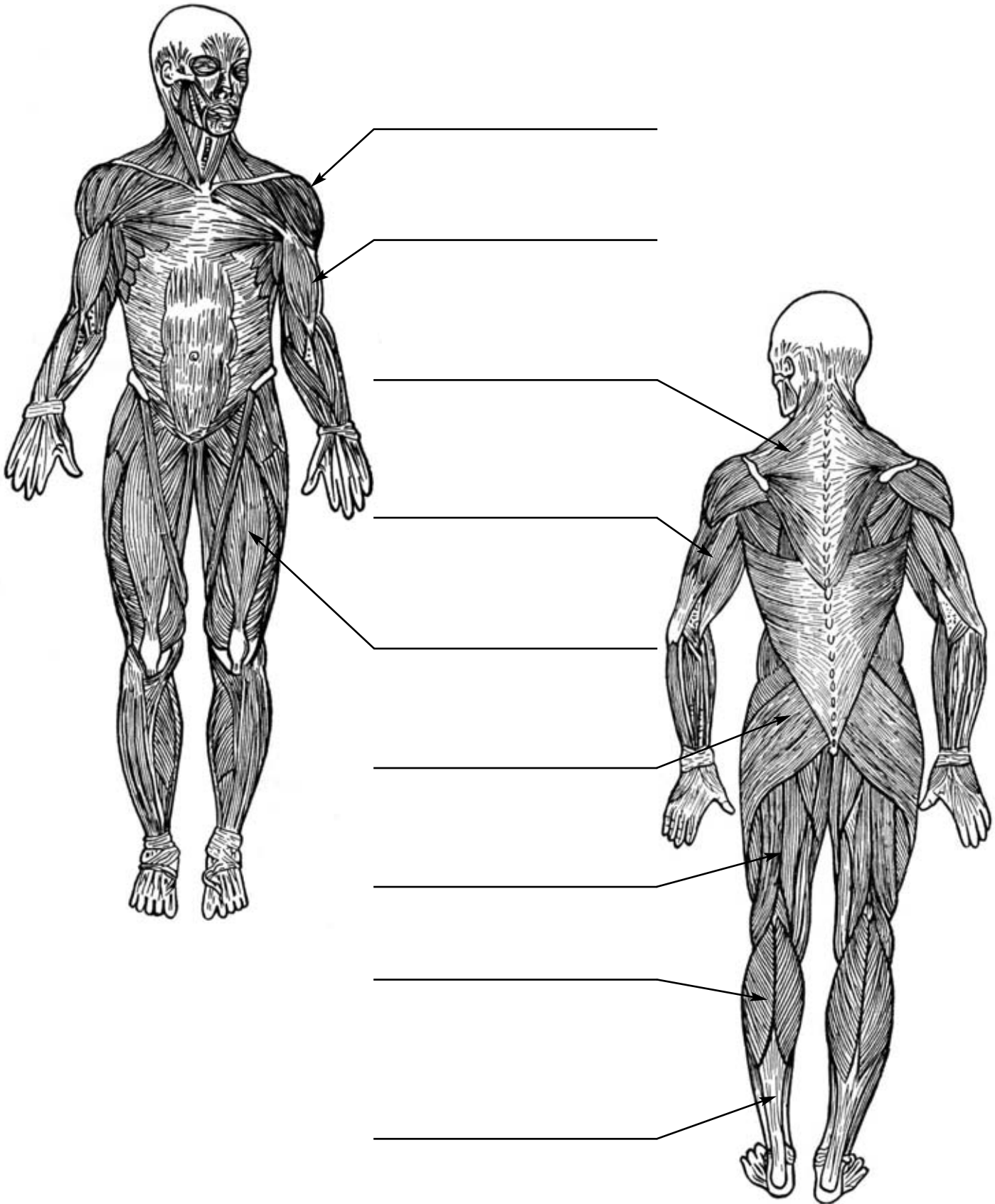
INSTRUCTIONS: In the first column, write what you know about muscles. In the middle column, write questions you would like to find answers to in *Get Moving! All About Muscles*. After reading, write what you learned about muscles in the last column.

Get Moving! All About Muscles

What I Know	What I Want to Know	What I Learned

Name _____

INSTRUCTIONS: Use your book to label the muscles shown on the diagrams below. Find: *trapezius*, *deltoids*, *biceps*, *triceps*, *quadriceps*, *gluteus maximus*, *hamstring*, *calf muscle*, and *Achilles tendon*.



How Sound Works

A Reading A-Z Level U Leveled Reader

Word Count: 1,637



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How Sound Works



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Reading Recovery	24
DRA	40



Table of Contents

Listening for Sound	4
Where Do Sounds Come From?	5
A Closer Look at Sound	9
Hearing Sound	13
How to Describe Sound	16
How Is Sound Used?	17
Enjoying Sound	21
Conclusion	22
Glossary	23
Explore More	24
Index	24



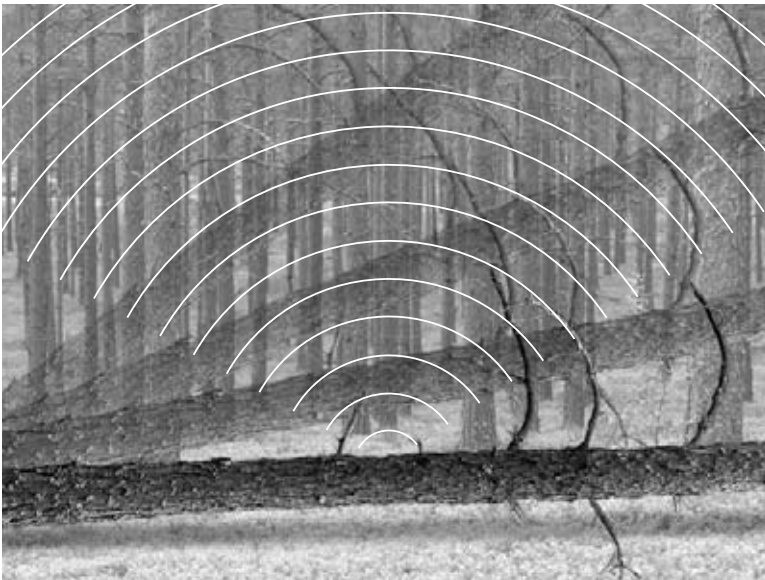
Listening for Sound

Choose a spot and close your eyes. Listen carefully to what you hear. If you are in a classroom, you might hear voices, lights humming, or even pages turning. If you are outside, you might hear traffic noises or animal sounds, such as dogs barking or birds chirping. If you're in your living room, you might hear other sounds.

Where Do Sounds Come From?

Ponder this—if a tree falls in the forest and no one is around to hear it fall, does it still make a sound? The scientific answer is yes.

Sound is a form of energy caused by something **vibrating**. Vibration occurs when an object moves quickly back and forth. The greater the vibration, the more sound energy is created. When the tree falls, it moves the surrounding air and makes it vibrate. Sound moves outward in all directions from the falling tree. A crashing sound would be heard if someone were around to hear it.



A tree falling in the forest creates sound waves.

Sound moves away from the tree in waves. **Sound waves** move through air, water, and solids. That means when an object vibrates, it causes vibrations in the matter that surrounds it. When the tree falls, it sends out sound waves in all directions through the air and through the ground on which it falls.

Bees' wings provide another example of how sound moves. The wings make the air around them vibrate, which causes a buzzing sound. The sound waves created by the bee's wings move away from the bee in all directions. No matter where you stand in relationship to the bee, you can hear the buzzing sound.



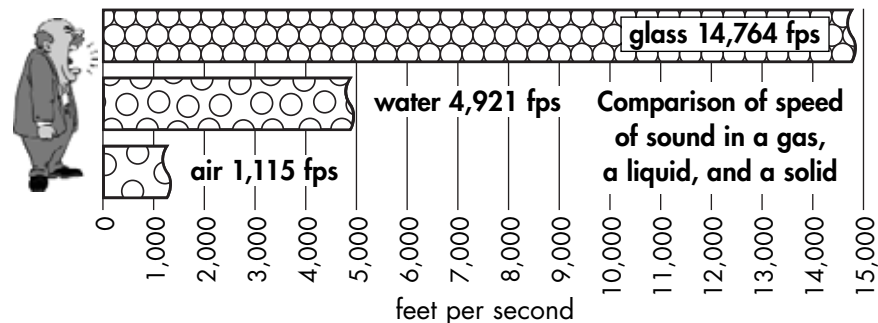
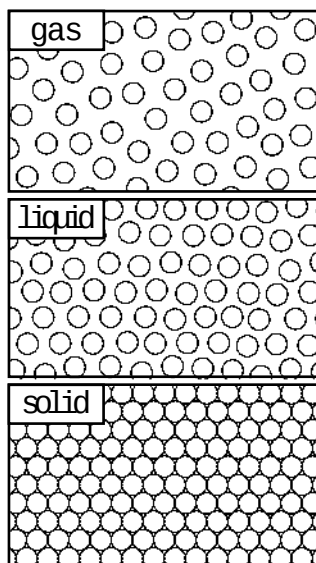
Beating wings create the buzzing sound that bees make.

Try This! Vibration

- Hold a ruler flat on a desk or table with one hand.
- Hang one end of the ruler over the edge.
- Pull the ruler down with your other hand, and let it go.
- Watch carefully to see the vibration of the ruler.
- Listen to hear the sound that it produces.
- Is the sound like a buzz or a hum? Maybe it is more like a "twang." Feel the ruler vibrate.
- Try this with different lengths of the ruler hanging over the edge. How does the sound change? Why does it change?



Sound travels differently through different types of matter. The distance between particles in matter is what causes the difference. In gases, such as air, the particles are farther apart than they are in liquid. In liquids, such as water, the particles are farther apart than they are in solids.



Particles that are closer together transfer sound energy more easily to one another. Sound transfers quickly through solids because the particles that make up most solids are close together. The transfer of sound is much slower in liquids and air because the particles are farther apart. Overall, the speed of sound varies, especially in gases. Sound travels more quickly in colder air than in warmer air because the particles are closer together.

Try This! Sound in Solids

- Tap on your desk with a pencil.
- Listen to the sound.
- Put your head down so your ear touches the top of the desk.
- Tap on the desk again. How is the sound different? Why?



Math Minute

On average, sound travels about 1,082 feet per second through air. Some jet planes travel faster than the speed of sound. When they break the **sound barrier**, a loud **sonic boom** can be heard for miles away.

There are 5,280 feet in one mile. A jet flying six miles above the ground breaks the sound barrier. How long will it take for someone on the ground to hear the sonic boom?



A Closer Look at Sound

There are many different kinds of sound. The characteristic of a sound wave determines what kind of sound it is. Two of the more common characteristics of sound are **pitch** and **intensity**, or loudness.

Pitch has to do with how high or low a sound is. A siren or whistle has a high pitch. Thunder or a bass drum has a low pitch.

Pitch depends on something called **frequency**. Frequency is determined by how fast an object

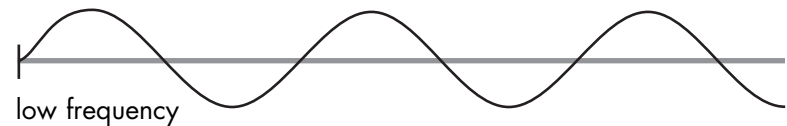
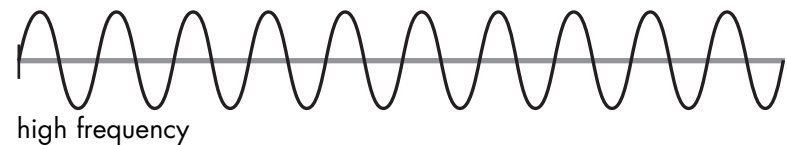


Hummingbird wings vibrate rapidly to make a high-pitched sound.

vibrates. An object that vibrates fast has high frequency and makes a high-pitched sound. An object that vibrates slowly has low frequency and makes a low-pitched sound.

High-frequency sound waves are more **compressed**, or closer together. Low-frequency sound waves are farther apart. Because high-frequency sound waves are more compressed, more waves pass by a given point in one second than in low-frequency waves, which are more spread out.

Sound Wave Frequency



Frequency is measured in a unit called **hertz** (hurts). One hertz means one wave passes by a point every second—in other words, one vibration occurs each second. Humans hear sounds that have a frequency between 20 and 20,000 hertz.

If an object vibrates less than 20 times per second or more than 20,000 times per second, you probably will not hear it. Some animals, such as dogs, can hear sounds above 20,000 hertz. Each different sound has a different frequency. For example, humans can make different sounds that range from about 100 to 1,000 hertz.

Now let's look at intensity. Intensity has to do with how loud a sound is. It also has to do with the amount of energy a sound wave contains. Loud sounds have more energy than quiet sounds. Thunder has lots of energy and can be very loud. The buzzing sound of a mosquito has very little energy and is not very loud. As sounds move away from their source, they lose energy and become softer. The intensity of a sound gets less and less as you get farther away from the object making the sound.

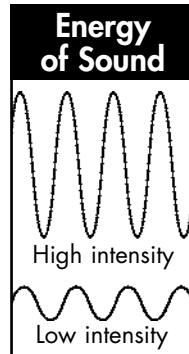


Table of Decibels			
Sound Source	Decibels	Sound Source	Decibels
Whisper	.20	Leaf blower	110
Hair dryer	.60–90	Rock band or siren . .	120
Telephone ring	.80	Jet airplane	150

Loudness or intensity is measured in a unit called a **decibel** (DES-eh-bl). You can barely hear

a sound of 10 decibels. But a sound of 70 decibels is considered loud. In fact, a 70-decibel sound has about 1,000 times more energy than a 40-decibel sound. If a sound reaches 140 decibels, it has so much energy that it will damage your ears.

Try This! Pitch Practice

- Gather a group of same-sized drinking glasses. Use glass, not plastic.
- Fill each glass with a different amount of water.
- Tap on the lip of each glass with a metal spoon.
- Listen to the pitch.
- See if you can arrange the glasses from high to low pitch.
- Try changing the amount of water in each glass.
- Try different-sized glasses or containers.





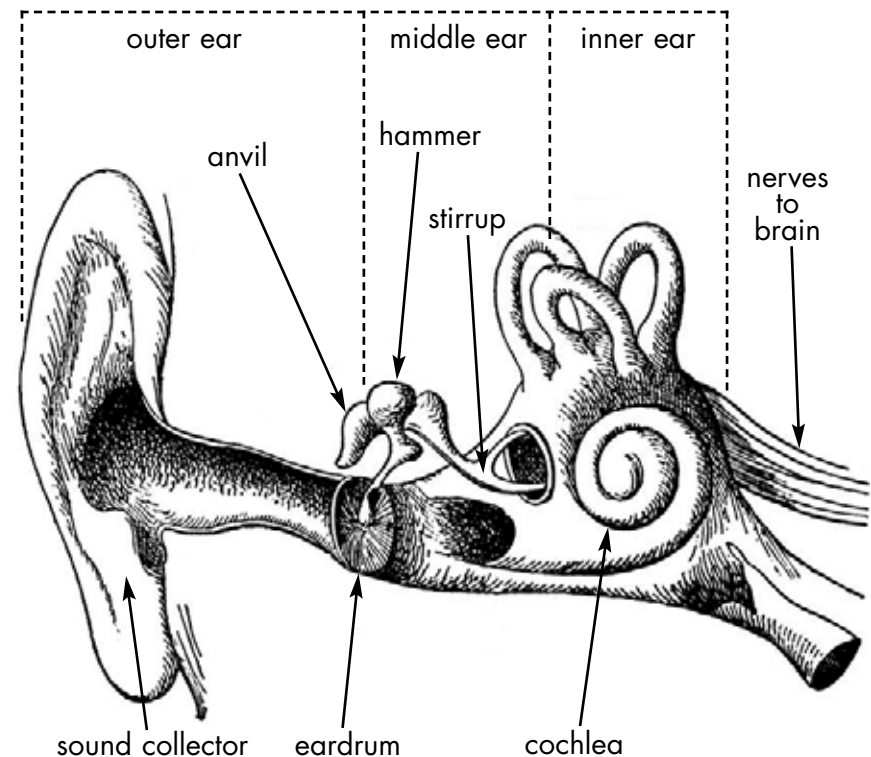
Hearing Sound

Ears play a big part in the ability to hear sounds. The outer ear plays only a small part in the hearing process. It acts like a sound collector. Its shape helps gather sound waves and move them along to the middle ear. The middle ear and inner ear are designed to transfer sound waves to nerves that carry signals to the brain. The brain then interprets the sound and gives your body commands to respond to the sound. For example, if the sound of an alarm clock reaches your brain, the brain tells your muscles to get you out of bed.

Your middle ear has an eardrum that vibrates when sound waves hit it. The eardrum transfers vibrations to three tiny, sensitive bones. It is important to be careful around loud noises, such as loud music or machinery, which can damage the middle ear. Some damage can cause permanent hearing loss.

The tiny bones transfer the sound waves to the inner ear. The inner ear has a snail-shaped part called a **cochlea**. It contains liquid and tiny nerve cells that change the sound vibrations into electrical impulses that are sent along nerves to the brain. The brain can then figure out what sound is being heard and tell your body how to react.

Parts of the Human Ear



The ear is what makes it possible for humans to hear.



Do You Know?

Many people with hearing difficulties learn to communicate without sound. They use sign language and their other senses to communicate with the world around them. These children have hearing aids to help them hear.

Devices can be used to help people hear. Hearing aids change the sound frequency and help sound waves to travel through the ear. There's also an operation that involves inserting a cochlear implant. This operation has helped many people hear what they couldn't hear before. It takes time for the brains of people with new hearing aids or cochlear implants to learn what sounds are being heard.

How to Describe Sound

The brain connects the message it receives from the ear with your own knowledge. Sound is often described by what makes the noise—for example, it sounds like a horn.



ring



roar

Sometimes sound is described by the noise it makes, such as a beeping sound. Words that imitate sounds are called **onomatopoeia** (ahn-o-mat-o-PEE-ah). *Plop*, *screech*, *bang*, and *swoosh* are all examples of onomatopoeia. So are the sounds animals make—*meow*, *woof*, *growl*, and *hiss*.

What could be making the noises in this chart?

Pitch	Intensity	Onomatopoeia	Object
high	loud	whee	
low	soft	splash	
high	soft	ribbit	
low	loud	roar	

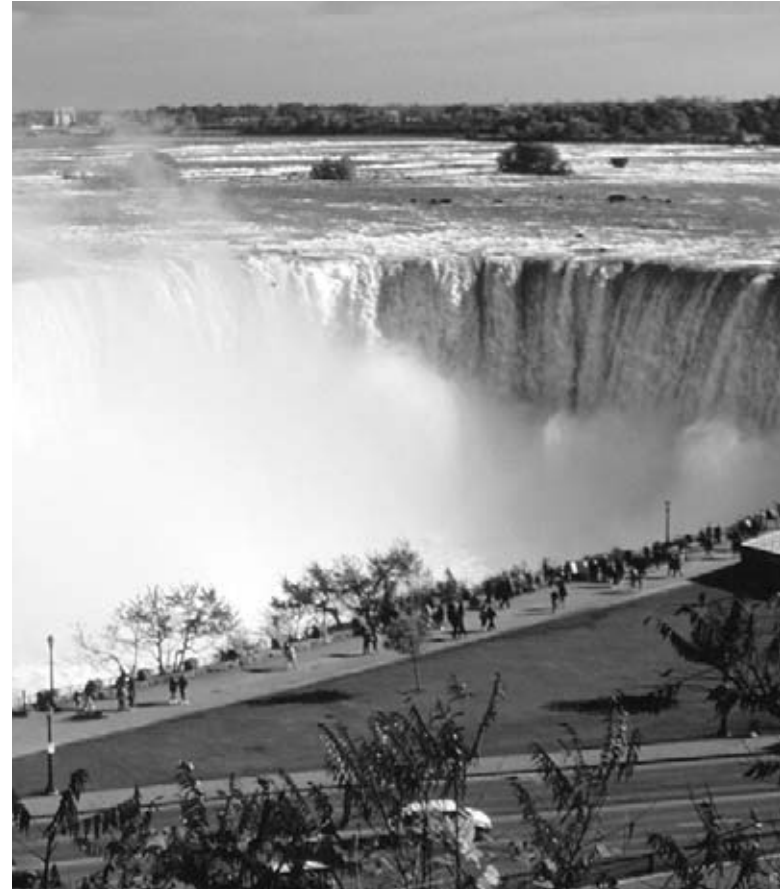
How Is Sound Used?

People and other animals have used sound from the beginning of time. People communicate by talking and listening. Laughter is a sound people make when they are happy. The sound of someone crying usually means they are sad or hurt.



Wolves howl to communicate with other members of their packs.

Other animals also communicate with sounds. Animals make noises that can say, "Danger is near" or "I'd like to get to know you." Different sounds mean different things. For example, a loud bang might mean "WATCH OUT!" to both people and other animals.

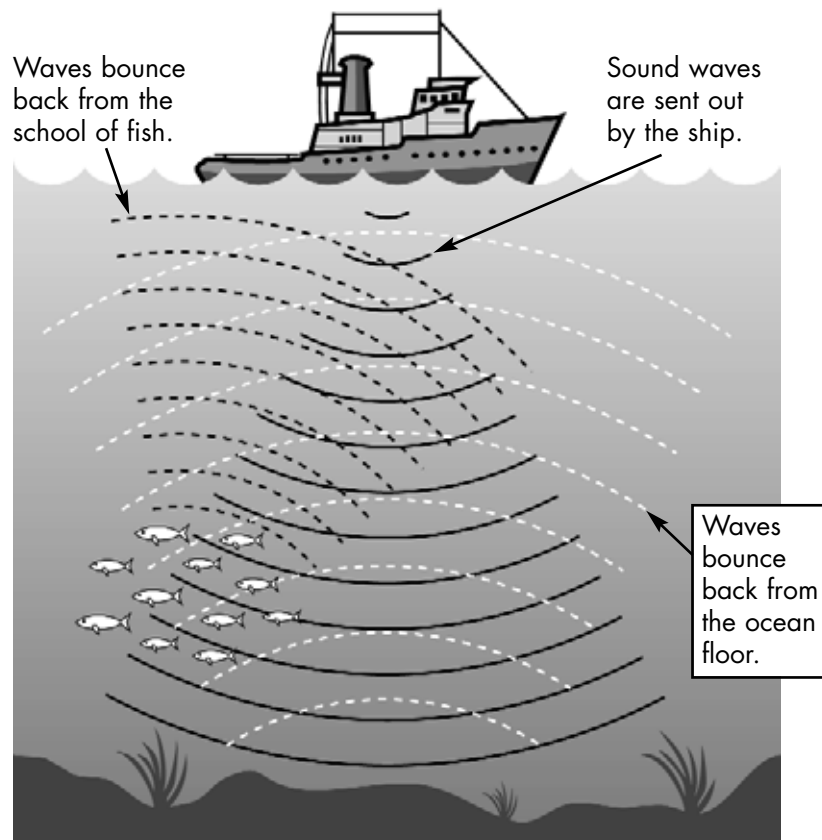


Waterfalls often can be heard well before they are seen.

Sounds also can give immediate information about the environment. A low rustling in the bushes, for example, tells that something is moving around in there. A whistling in the trees might mean it is getting windy. Dripping or trickling noises indicate that water is nearby. A foghorn signals a ship that a dangerous object might be in its path.

In modern times, humans have found new ways to use sound. People use sound waves to search for schools of fish in deep ocean waters. **Sonar** uses waves that are sent out and return with a different frequency when they bounce off objects. Using this sounding technique, fishers can tell when fish are under their boats.

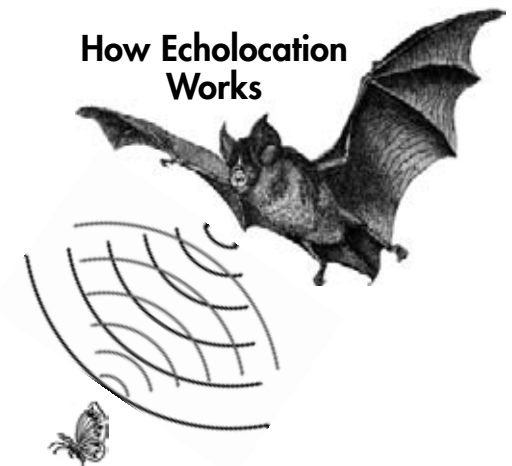
Many animals have built-in sounding systems to help them navigate and find food.



When hit by sound waves, objects reflect different frequencies.

Bats use a technique called **echolocation**. They send out sound waves that are reflected back by insects, trees, or other objects. When the waves bounce off objects and come back to the bats, the waves are a different frequency. This technique allows bats to find food at night when they hunt. Dolphins also use sonar to help them find their way around the ocean.

- ❶ The bat sends out a constant stream of beeping noises.
- ❷ The sound waves spread out ahead of the flying bat.
- ❸ Sound waves strike objects, such as flying insects.
- ❹ Sound waves bounce off the insects and echo back to the bat.



- ❺ The bat picks up the reflected sound with its super-sensitive ears.
- ❻ Nerves carry a signal from the bat's ears to its brain. The brain interprets the size, distance, speed, and direction of the insect. Zap — it's dinnertime.

Sound waves also are used to take pictures inside a human body. Using **ultrasound**, doctors can see a baby inside its mother's body before it is born. As with sonar, sound waves reflect off the baby and return at a different frequency.



The group Stomp uses brooms to make music.

Enjoying Sound

Musical instruments have been created from experiments with different types of sounds. A famous group called Stomp uses garbage cans, brooms, and pipes to make music. Once they even danced on top of an old school bus as part of a concert. Sounds can make people feel strong emotions. Even a kitten purring or a mother humming to her baby can create feelings of calm and love.

People can describe their experiences based on sounds. If someone talks about the ocean, you can almost hear the water crashing on the beach. Or you might hear sea gulls squawking or squeals of delight from other beach-goers.



Conclusion

The world is filled with sound energy caused by objects vibrating all around us. Many kinds of sound waves moving through the air cause sounds that may be loud or soft, high or low, pleasant or annoying.

Pay close attention and discover new sounds that can provide information about the world around you. Sound helps to explain things, gives details about settings and objects, and creates emotions and feelings. Think about all the ways sound enters your life.

Glossary

cochlea	snail-shaped tube with nerve fibers, which is found in the inner ear (p. 14)
compressed	squeezed together (p. 10)
decibel	a unit that measures the loudness or softness of sounds (p. 11)
echolocation	a method of locating objects using sound waves bounced off objects (p. 20)
frequency	rate of vibration of a sound wave (p. 9)
hertz	unit of measure of sound frequency (p. 10)
intensity	the amount of energy per unit of sound (p. 9)
onomatopoeia	words that imitate sounds and noises, such as <i>hiss</i> or <i>beep</i> (p. 16)
pitch	the highness or lowness of a sound (p. 9)
sonar	system that sends high-frequency sound waves through water and registers the vibrations reflected by an object (p. 19)
sonic boom	explosive sound made by aircraft moving faster than the speed of sound (p. 9)
sound barrier	large increase in air resistance encountered by aircraft flying at the speed of sound (p. 9)
sound waves	the form in which sound travels (p. 6)
ultrasound	sound with a frequency above what humans can hear (p. 20)
vibrating	moving back and forth quickly (p. 5)

Explore More

On the Internet, use www.google.com to find out more about topics presented in this book. Use terms from the text, or try searching for glossary or index words.

Some searches to try: *sound waves*, *onomatopoeia*, or *hearing loss*.

Index

brain(s), 13-16
 cochlea, 14, 15
 communicate, 15, 17
 decibel, 11, 12
 eardrum, 13, 14
 ear(s), 8, 13-16, 20
 echolocation, 20
 fish, 19
 frequency, 9-11, 15, 19, 20
 hearing aids, 15
 hertz, 10, 11
 intensity, 9, 11
 liquids, 7, 8
 onomatopoeia, 16
 pitch, 9-12, 16
 ruler, 7
 solids, 7, 8
 sound wave(s), 6, 10, 13, 14, 19, 20, 22
 travel(s), 7-9, 15
 ultrasound, 20
 vibrate(-ing) (-ion) (s), 5-7, 10, 13, 14, 22



Name _____

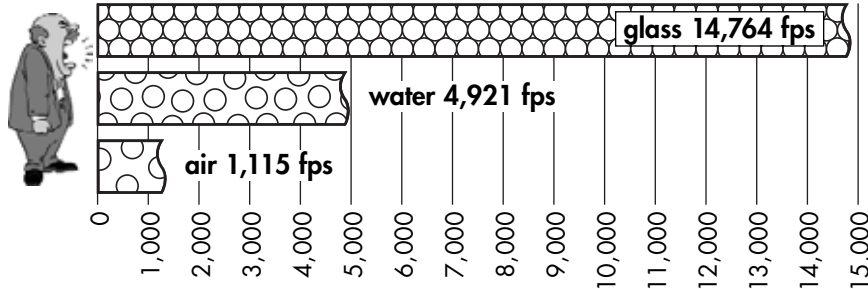
INSTRUCTIONS: Use chapters 3, 4, 5, and 6 of *How Sound Works* to complete the chart below. Write the main idea for each chapter in the left-hand boxes. List up to three details that support each main idea in the right-hand boxes.

How Sound Works	
Chapter 3	Details 1. 2. 3.
Chapter 4	Details 1. 2. 3.
Chapter 5	Details 1. 2. 3.
Chapter 6	Details 1. 2. 3.

Name _____

INSTRUCTIONS: Use the graph on page 8 of *How Sound Works* to answer the questions below.

Title: _____



unit of measurement: _____

1. Write the title of the graph on the appropriate line above.
2. Write the unit of measurement on the appropriate line above.
3. How many feet per second do sound waves travel through water? _____
4. Through what solid do sound waves travel the fastest? _____
5. How many feet per second do sound waves travel through air? _____
6. What do the numbers at the bottom of the chart represent? _____
7. How many feet per second do sound waves travel through glass? _____
8. Why doesn't the bar for water stop directly on the 5,000 fps line? _____
9. What does the man at the left of the graph represent? _____

Name _____

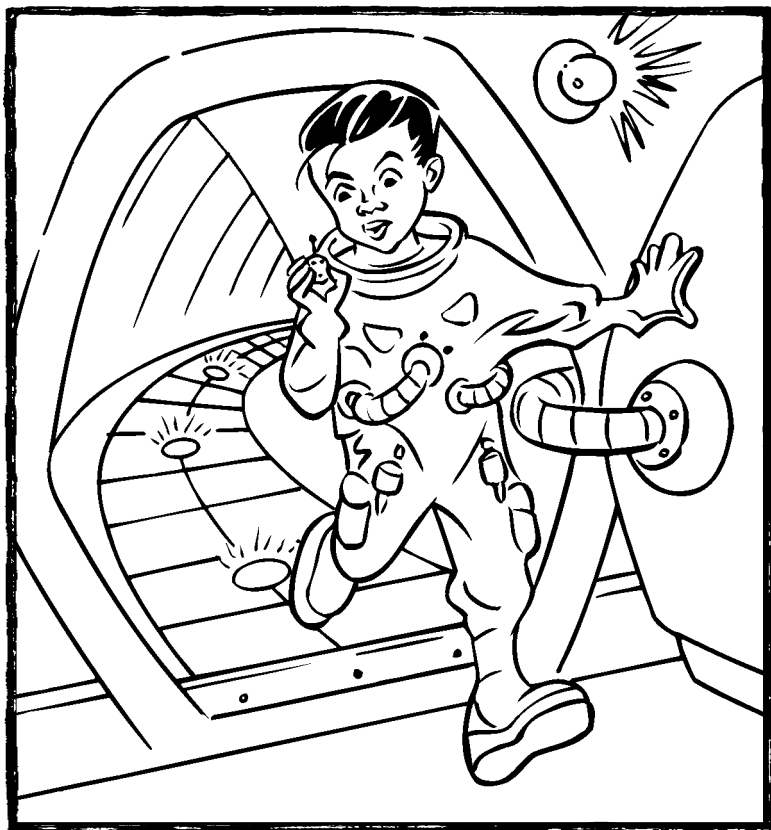
INSTRUCTIONS: Circle the conjunctions in the sentences below.

1. Sound travels quickly in cold air because the particles are closer together.
2. They say, "Danger is near" or "I'd like to get to know you."
3. People laugh and cry.
4. You may hear the waterfall but not see it.
5. They make dripping, whistling, or trickling noises.
6. Ultrasound waves reflect off the baby and return at a different frequency.
7. Echolocation occurs when the sound waves are reflected back.
8. We hear because the ear transfers sound waves to the brain.
9. Fishers use sound waves so they are able to find fish.
10. The tree fell, yet no one heard it.

The Great Gallardo's Books

A Reading A-Z Level U Leveled Reader

Word Count: 2,063



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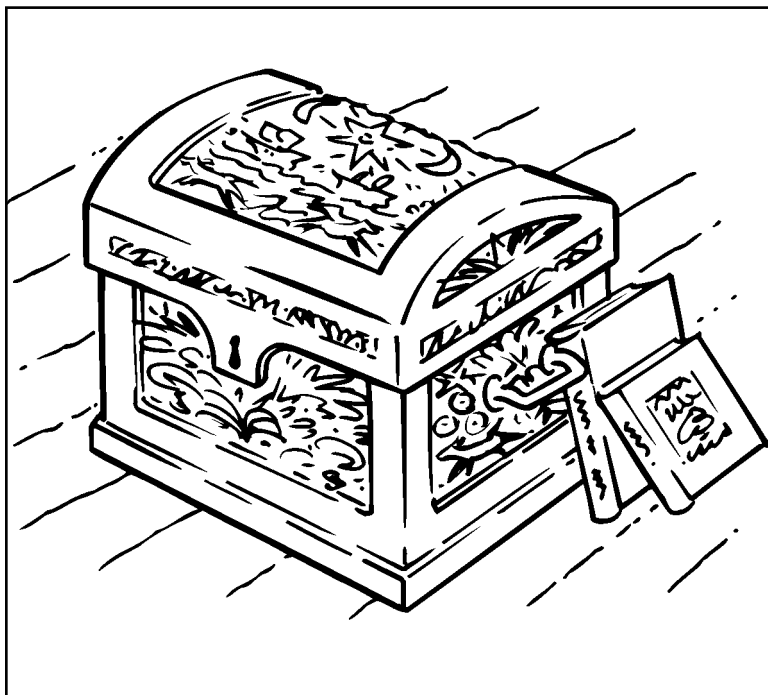
The Great Gallardo's BOOKS



Written by Lori Polydoros
Illustrated by David Cockcroft

www.readinga-z.com

The Great Gallardo's BOOKS



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Note: *The Great Gallardo's Books* is the first in a continuing series written by Lori Polydoros. Travel with Miguel Ventura and his family as they experience classic adventures.

The Great Gallardo's Books
Level U Leveled Reader
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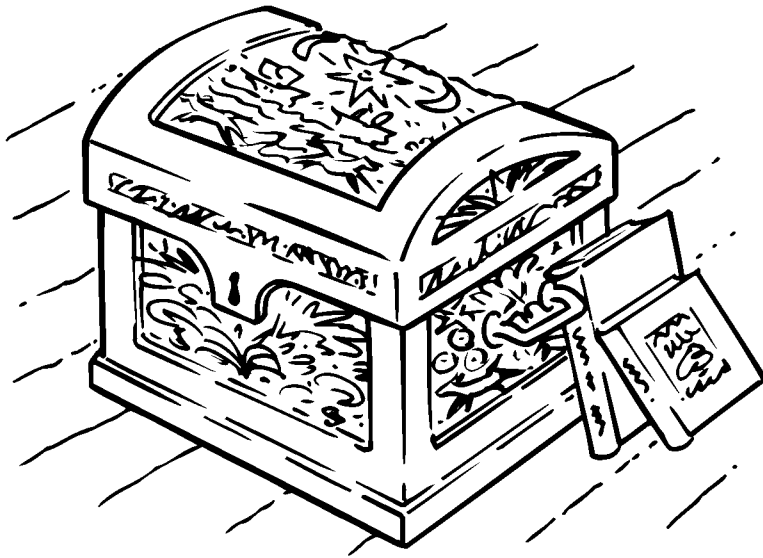


Table of Contents

One Boring Saturday	4
The Loft	6
Benjamin's Bathtub	8
Under the Cowboy's Hat	11
The Creature From Copernicus Crater	15
Great-Grandpa George	21
Glossary	24

One Boring Saturday

Raindrops splattered the asphalt like a million exploding firecrackers. Miguel lined up toothpicks in the shape of a rocket ship on the counter. Working at his family's sandwich shop was not Miguel's idea of an exciting Saturday afternoon. Neither was doing homework. He had an essay due on Monday, and, of course, he hadn't even started!



"It's slow now," Miguel's mom said. "Go start your essay."

"It's too hard." Miguel munched the last pickle from the jar. "I can't write an essay about 'Reading Is an Adventure'."

"That doesn't sound so bad," Miguel's mom said.

"It does to me."

"Peel these." She slid a box of cucumbers over to him. "Or start your essay."

Not much of a choice, Miguel thought.

"Fine, I'll do the essay." He dragged himself to the backroom and plopped down on a box. He stared at the lines on his paper. His mind was empty, like the pickle jar. *How could reading be an adventure?*



The Loft

A tall, red ladder stood along the wall and Miguel wandered over to it. Miguel's mom used the ladder to reach the high boxes in the storage room. The ladder was so old that strips of red paint peeled off the wooden rungs. Miguel put his foot on the first rung and looked up—a loft he'd never noticed!

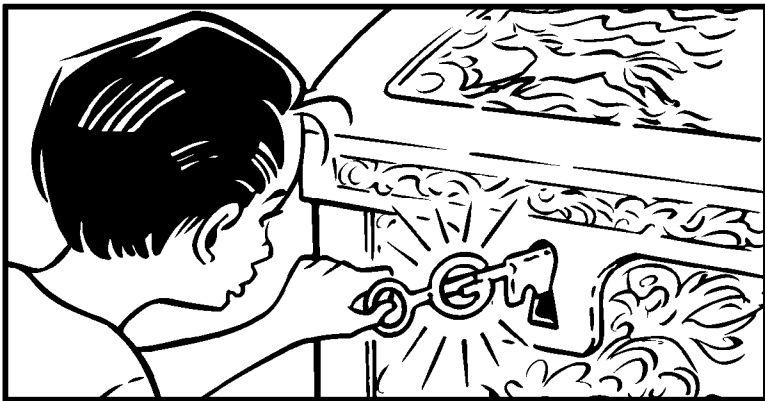
Miguel tugged himself quickly up the ladder. Crack! The topmost rung snapped. Miguel began to slide.

His heart raced. Red paint chips fluttered down onto his hair like **confetti**. Miguel caught his foot on a rung and pushed off hard, leaping up into the loft. He made it!



Miguel found dusty boxes stacked to the ceiling, old magazines and newspapers littering the ground, and a sagging, purple couch. Old posters **plastered** the walls—posters that even in their faded condition, screamed with color and interesting designs. One read *The Great Gallardo!* It showed a hooded figure beneath an arch of shooting stars. A glittery black chest with a lock fit snugly up against the couch. Tiny pictures carved into the wood seemed to dance across the lid—ships sailed, horses trotted, and stars twinkled.

Miguel looked down at his feet and found an old **skeleton key**. Its shape and shine had almost worn away, but a golden letter G still beamed through its dullness. Miguel knelt next to the chest. He cleared cobwebs from the keyhole and turned the key in the lock. It clicked!



Benjamin's Bathtub

Miguel lifted the lid to the old chest, hoping to find gold coins, jewels, or swords inside. He peeked inside, and his heart sank. The chest was full, not with treasure, but with books.

"Who would keep old books in such a cool trunk?" he asked himself, picking up a thick, black book with fancy lettering: **The Story of Benjamin Franklin**.

"Ugh," he muttered, "a boring **biography**." He tried to put the book back, but for some reason he felt he had to open it. He focused on the words, **Chapter Eight: Benjamin's Bathtub**, when his mom's voice distracted him.

"Miguel, what are you doing?" she called out from the diner's front counter.

"Reading."

"Really?" his mom asked.

"Yeah, really."

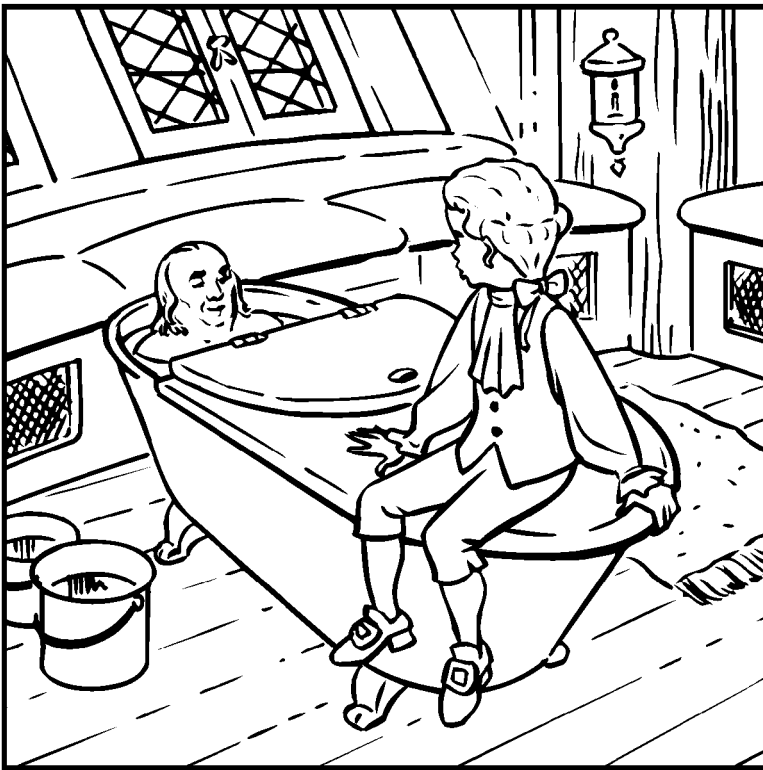
He glanced back down at the words: *During the American Revolution . . .* but they became strangely fuzzy and danced around on the page.

asked Benjamin to Franklin France. was to Congress go

Miguel squeezed his eyes shut. His balance shifted, as if the floor moved beneath him. Salty air stung his eyes and tingled his tongue. Miguel no longer smelled the dusty, old loft . . .

"I'm an old man of seventy," a man's voice called out, "on a **perilous** journey to France."

Miguel opened his eyes to find himself aboard a ship on the ocean, sitting on a wooden lid that covered a . . . a bathtub! One end of the lid was open, and out popped an old man's head.



"Temple, my grandson, America shall be free!" The man looked directly at Miguel.

An image of a face on an old half-dollar that he had gotten from his own grandpa flashed before Miguel. This was Benjamin Franklin!

Miguel had been **transported** into the biography he had flipped open, and now Ben Franklin thought Miguel was his grandson, Temple!

"Ah, I do wish I were in fair health like you," Ben said. "Then I could make my daily swim at sea. Now I must **resort** to these baths to soothe my aching joints."

Miguel tried not to giggle—biographies could reveal **intimate** details about a person. Miguel remembered learning that Ben Franklin traveled to France to ask for help in America's fight against the British. He couldn't imagine that Franklin actually brought along a bathtub!

"I have so many questions," Miguel started.

But before he could finish, Ben Franklin's face blurred. Miguel shut his eyes and held his breath. The dusty smell of the loft once again tickled his nose. He was back.



Under the Cowboy's Hat

Miguel shut the biography and put it back in the chest. *How could that have happened?* he thought. *Maybe reading biographies isn't so boring after all.*

A leather-bound book titled **Riding Roundups** sat in the row next to the Ben Franklin biography.

"Must be a **western**," Miguel said, looking at the cowboys on the cover.

He opened the book and read. Just as Miguel turned the page to **Chapter Five: Under the Cowboy's Hat**, the words flipped upside down and backward.

!!la fo skcirt tsedliw eht wenk dna spudnuor eht edir dluoc xaM yobwoC.

Miguel covered his eyes with his hands. A strong wind that blew against his cheeks brought with it the smell of sweet **sagebrush**—and stinky cow manure. Miguel was on the prairie, surrounded by a dozen cowboys and hundreds of longhorn cattle.

"**Lasso** those horns!" a cowboy shouted at him from behind.

A rope trembled in Miguel's hands as he realized he'd become a cowboy in the Old West.

Before Miguel could take a breath, the cowboy slipped out his rope, flew past Miguel, lassoed the bull's horns, and circled his stallion around a tree. Miguel stared in **awe**.

"Cowboy Max," one of the other cowhands shouted, "is still as quick as lightning!"



"Get a move on, Greenie," Cowboy Max said, nodding his head toward Miguel.

Miguel remembered that cowhands in the Old West drove longhorn cattle up trails from Texas to Kansas. Being called a "greenie" must mean that he didn't know what he was doing. *Boy, are they right!* he thought.

Back at camp the smell of coffee and smoked meat hung in the air. Miguel watched the men sitting near the fire playing poker and telling stories. Cowboy Max removed his black hat and out fell a long gray braid tied with a red ribbon.

Miguel's mouth dropped. Cowboy Max was a lady!

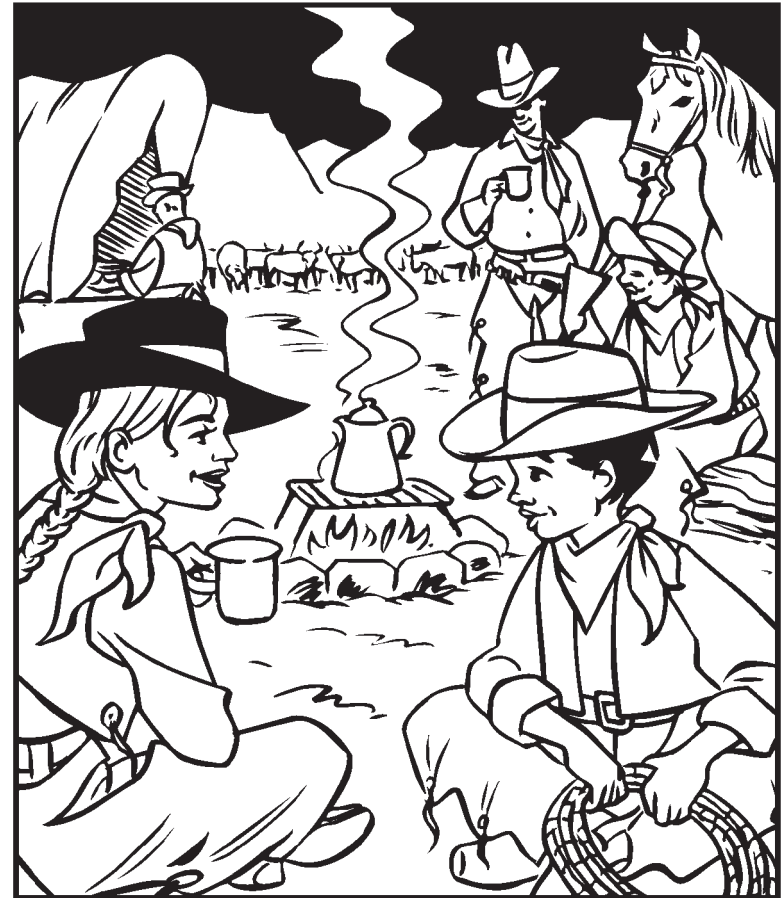
She smiled at Miguel. "Sorry, Greenie, thought you knew."

He shook his head. "They call you Cowboy Max."

"It's short for Maxine," she said. "Some people don't like women who wear **breeches** and speak up for themselves."

"You still ride?"

"You bet," said Maxine. "I'm my happiest when I'm with my herd."



"You're brave," said Miguel.

"Just lucky," she said. "I get treated fairly in these parts. A lot of women ranchers don't."

Miguel had many questions, but the stars began to blur. He felt dizzy, so he shut his eyes. In an instant, Miguel found himself back at the loft.

The Creature from Copernicus Crater

Miguel sat down on the floor. Life was tough on the prairie, especially for women. He never imagined westerns were so interesting! It was getting late, but Miguel had to try one more book.

A small book with a silver moon on the cover called **The Creature from Copernicus Crater** grabbed his attention.

Science fiction? he thought. *That's weird, the first chapter starts on page 214.*

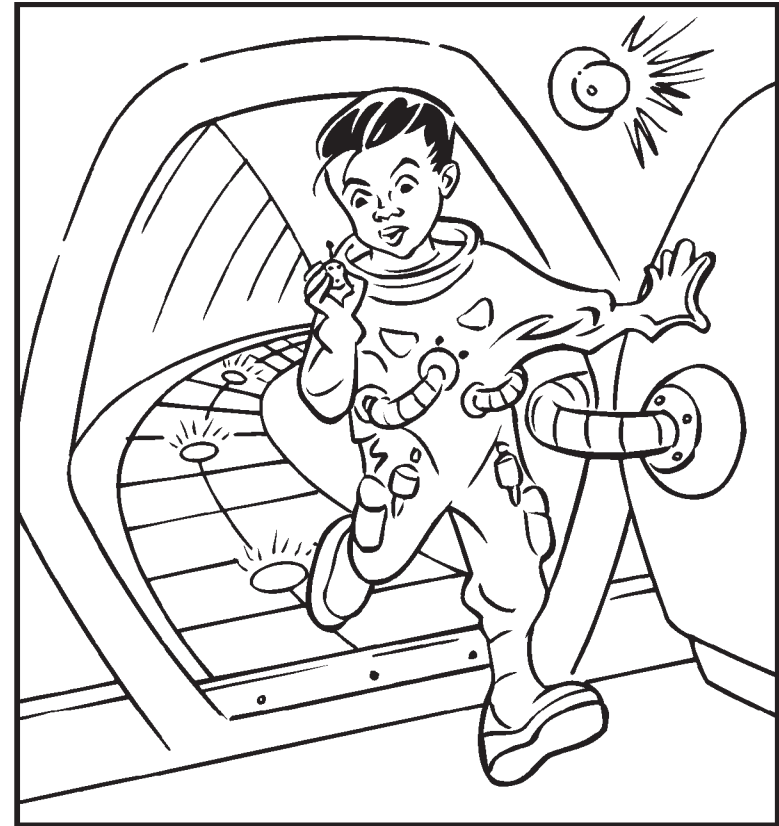
Miguel began to read, "Colonel Chan guarded the underground lunar outpost. He hadn't seen another living thing for two years until . . ." Suddenly the words streamed together.

a dangerous and mysterious creature appeared near the crater!

Miguel shivered and closed his eyes. The air seeping into his nostrils smelled artificial, like at a hospital. Computers beeped in the distance. Miguel opened his eyes to find himself in an underground **laboratory**. Countertops were jammed with **high-tech** equipment—cameras, scanners, and other strange **contraptions**. Jars full of rocks, dust, and liquids filled the shelves. Miguel picked up a jar and read: Copernicus Crater Lunar Rocks.

"Lunar rocks?" Miguel whispered. "I'm on the moon!"

Miguel raced out the lab's door and through long, silent corridors, hoping to find a view of the moon. He followed the red lights that dotted the floor. He pushed open a door that read "Exit Room". Something beeped in the pocket of his jumpsuit. Miguel pulled out a radio communicator.



“Colonel Chan?” a woman said. “This is Mission Control.”

Miguel pressed the red button and tried to sound official. “This is Colonel Chan.”

“This is Colonel Lundy,” she said. “We need you to get outside now and investigate some strange activity near the **crater**.”

Miguel gulped. Being on the moon alone would be terrifying!

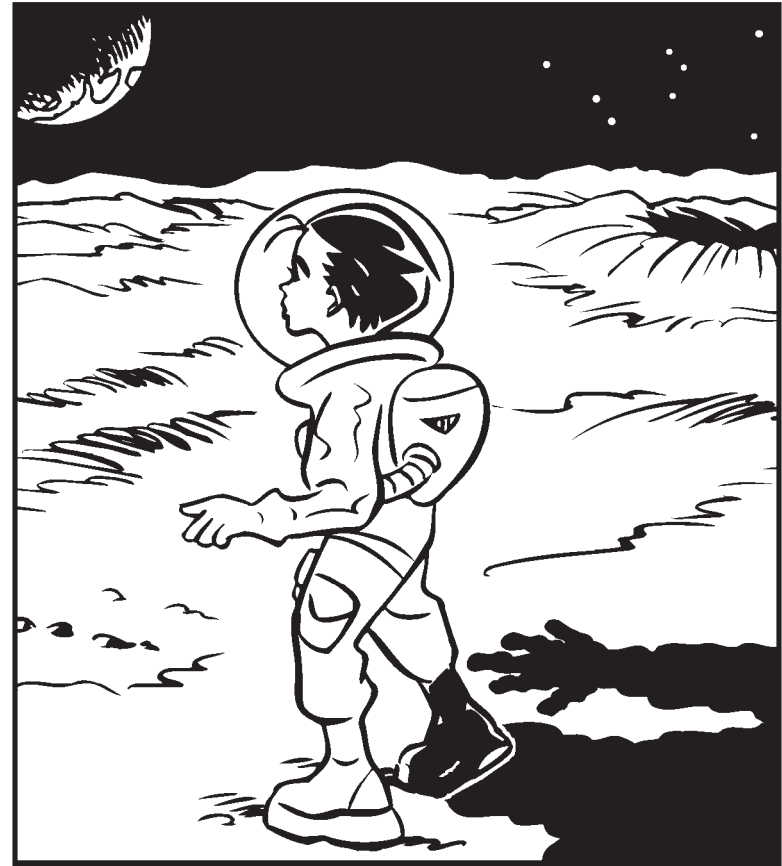
“Get out there now, and report back what you find.” Colonel Lundy said.

I can do it, he told himself as he tried to figure out how to work the spacesuit. *After all, I’m an astronaut now.*

He put on his helmet, engaged the door, and stepped out onto the moon . . .

The sky was deep black. Miguel stepped forward and hopped into the air. Lunar gravity made him as light as a feather! *I must weigh less than twenty pounds!* he thought.

He leaped and jumped across the silvery gray hills, leaving boot marks in the dust. He looked up and stopped dead in his tracks. There in the sky hung a crescent-shaped Earth!



Then Miguel sensed a dark shape moving toward him. He turned, and something struck him from behind, sending him sailing through the air like a helium balloon that had been cut free. He couldn’t stop! Miguel floated past a tower, clung to the side, and shimmied down to the ground. There, Miguel came face to face with the ugliest creature he’d ever seen!

Bulging, laser-like eyes glowed from the fleshy face of a creature almost as white as the moon. Miguel threw his body forward, hop-skipping out of there as fast as he could. Red laser eye-shots whizzed passed Miguel. He lunged for the lunar outpost in a panic. His breath fogged his visor. He tripped on a rock and tumbled forward, doing a complete somersault in the air. The creature groaned, its gooey arms almost upon him.

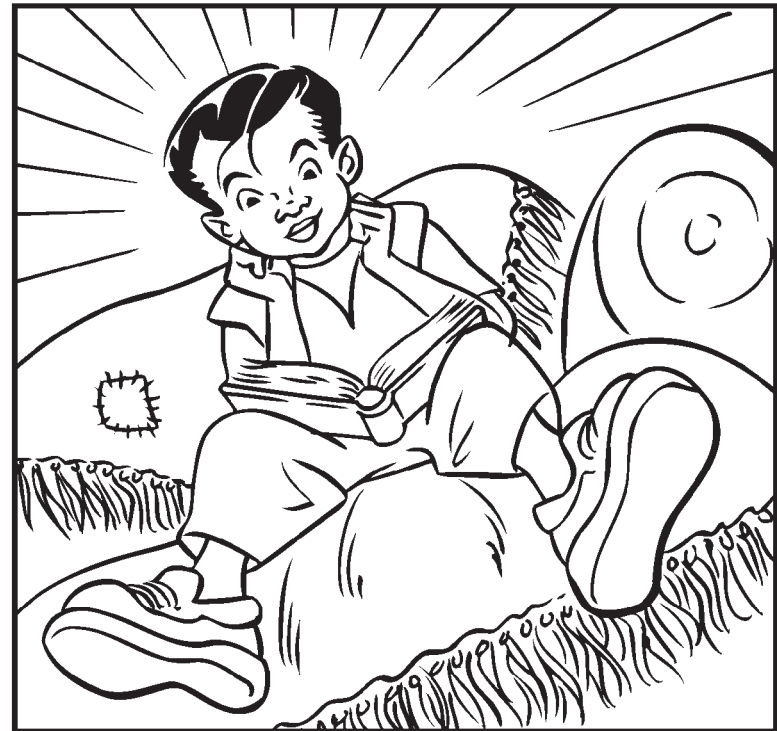


Miguel tapped all the buttons on the door panel, finally opening the door. He slipped through just in time! As Miguel stumbled in, he accidentally activated his radio communicator.

“Mission Control.”

“Something tried to kill me!” Miguel gasped.

But before anyone could answer, the Exit Room walls blurred. Miguel closed his eyes and was happy to feel the soft, warm couch beneath him.



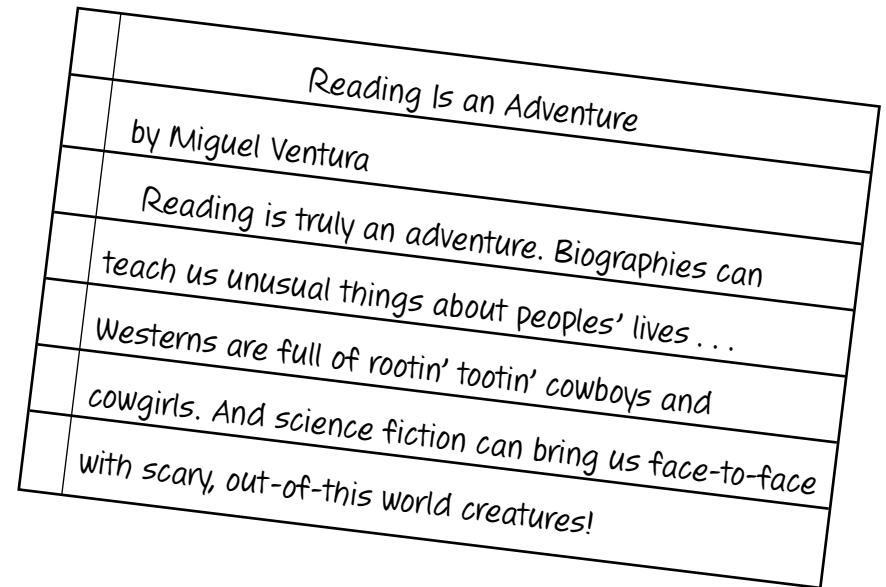


Great-Grandpa George

Miguel slumped over onto the chest. *Science fiction was terrifying and thrilling all at the same time!* he thought.

The shop would be closed soon, and Miguel knew that after his mom locked the doors, she would ask to see his essay. He put the books back, leaving the key in the lock.

When he got down from the loft, Miguel picked up his pencil. It felt good in his hand. Ideas were fresh in his mind, so Miguel's words flowed easily, like pouring syrup on pancakes.



Miguel finished his outline and read it to his mom.

"Not bad for someone who thinks reading is boring," she said.

"I found some stuff up in the loft back there . . ."

"Your great-grandpa's stuff?" his mom said.

"Great-Grandpa George?"

"Yes, he was a magician called the Great Gallardo!"

"Really?"

"He performed all over the world," she said. "And he ran his magic shop right here."

“Why didn’t you tell me?”

“Maybe I was waiting for the right time.”
Miguel’s mom winked. “You know the most magical thing about him?”

Miguel’s heart raced. “What?”



“He loved to read more than anything else.”

Miguel smiled.

His mom smiled back.

Thanks to The Great Gallardo’s books, maybe Miguel did too. He couldn’t wait to find more adventures in the glittery black chest in the loft.

Glossary

awe	feelings of wonder and respect (p. 12)
biography	a true story written about a person’s life not written by that person (p. 8)
breeches	slang for pants; especially short pants that end around the knee (p. 13)
confetti	small bits of colored paper thrown in celebration (p. 6)
contraptions	interesting, unfamiliar devices (p. 15)
crater	a hole or hollow formed by an impact often made by a meteor (p. 17)
high-tech	complex technology (p. 15)
intimate	most personal, private (p. 10)
laboratory	a place where experiments are done (p. 15)
lasso	rope or leather strip tied with a slipknot to catch animals (p. 12)
perilous	dangerous (p. 9)
plastered	fastened on or pasted on to cover (p. 7)
resort	to seek relief (p. 10)
sagebrush	a woody shrub with silvery leaves found in the dry, western United States (p. 12)
science fiction	fiction having to do with some actual or imagined scientific phenomenon (p. 15)
skeleton key	a key with teeth filed away so that it can open different, simple locks (p. 7)
transported	carried from one place to another (p. 10)
western	a story about life in the western United States, particularly in the late 1800s (p. 11)

Name _____

INSTRUCTIONS: Visit your school library to find two books for each genre below. Write whether the books are fiction or nonfiction. Then record the title in the final column.

Literary Genre	Fiction/Nonfiction	Titles
Biography	1.	
	2.	
Mystery	1.	
	2.	
Fantasy	1.	
	2.	
History	1.	
	2.	
Humor	1.	
	2.	
Poetry	1.	
	2.	
Science Fiction	1.	
	2.	

Name _____

INSTRUCTIONS: Find the similes in *The Great Gallardo's Books* and write them in the blanks. Below each sentence, write what two things are being compared. Finally, write a simile of your own to describe something or someone in the book.

1. His balance shifted, _____. (p. 9)

Comparison: _____

2. The air seeping into his nostrils smelled artificial _____. (p. 15)

Comparison: _____

3. _____ as light as a feather. (p. 17)

Comparison: _____

4. _____

like a helium balloon that had been cut free. (p. 18)

Comparison: _____

5. Bulging, laser-like eyes glowed from the fleshy face of a creature almost as

_____. (p. 19)

Comparison: _____

6. _____, like pouring syrup on pancakes. (p. 21)

Comparison: _____

7. My simile:

Name _____

INSTRUCTIONS: Write a synonym for each underlined word. Use a thesaurus or dictionary as needed.

1. He dragged himself to the back room and plopped down on a box.

2. Miguel found dusty boxes stacked to the ceiling, old magazines and newspapers littered on the ground, and a sagging, purple couch.

3. Old posters plastered the walls—posters that even in their faded condition, screamed with color and interesting designs.

4. Tiny pictures carved in wood seemed to dance across the lid—ships sailed, horses trotted, and stars twinkled.

5. The golden letter G still beamed through its dullness.

6. Who would keep old books in such a cool trunk?

7. A strong wind that blew against his cheeks brought with it the smell of sweet sagebrush—and stinky cow manure.

8. Miguel couldn't wait to find more adventures in the glittery black chest in the loft.

Page's School Report

A Reading A-Z Level U Leveled Reader

Word Count: 1,481

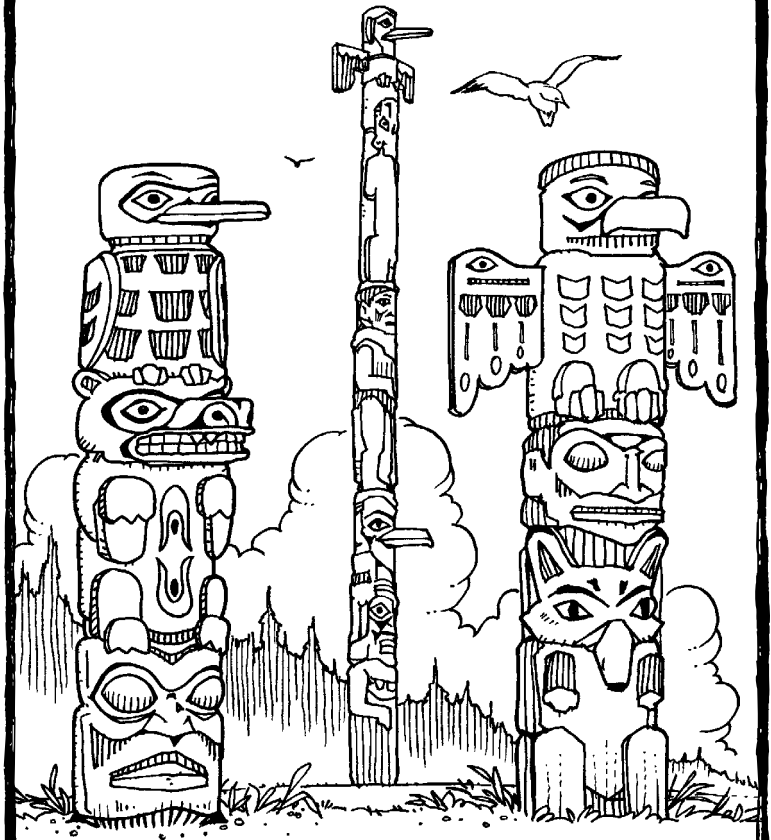



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Page's School Report



Written by Troy Wolff • Illustrated by Joel Snyder

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Reading Recovery	24
DRA	40

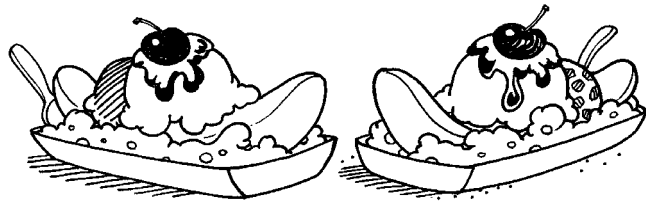
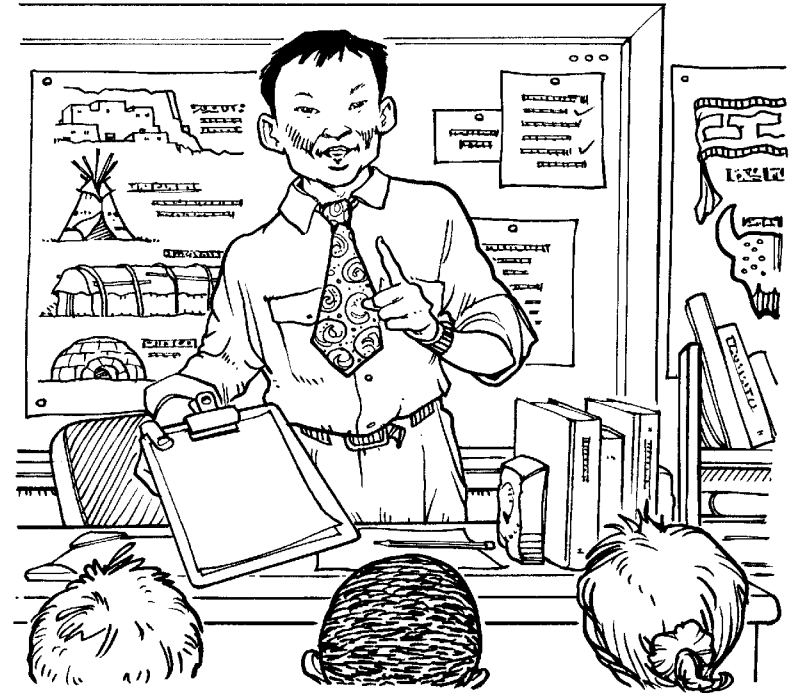


Table of Contents

Chapter One	4
Chapter Two	6
Chapter Three.....	8
Chapter Four.....	10
Chapter Five	13
Chapter Six	17
Glossary.....	20



Chapter One

"OK, class, here is your next task."

Page grabbed a pen.

"As you know, we have been studying the different Native American tribes that lived here before the European settlers arrived," Mr. Lee said. "Today, each of you will pick one tribe. In one week you will give a report on it to the class. I have a list of tribes for you to pick from," Mr. Lee continued. "Let's line up in alphabetical order, then pick the tribe you want to study."

Page let out a small groan. Her friend Jack let out a giggle. His last name was Alba—first on the class roll. Page’s name was Wales. She was the very last.

By the time Page got to Mr. Lee’s desk there was only one tribe left, the Makah.

“The Makah?” Page said to herself. *“I’ve never even heard of them.”* Out loud she said, “Thank you, Mr. Lee.”

“Page, the Makah are a very **interesting** tribe from the Pacific Northwest. I’m sure you’ll enjoy learning about them.”

Page had her **doubts**.



Chapter 2

That night, Page was on the phone with Jack. “Jack, you are so lucky!”

“I know. First pick of all the tribes,” he answered. “So I picked the Mohawk. Finding information on one of the largest tribes in the Northeast will be easy.”

Page replied, “And I’ve got some small tribe way up in the Northwest. How am I supposed to find anything on them?”

“Well, that’s what you get for having a last name that starts with ‘W’,” Jack teased.

“Yeah, and you, Mr. Alba, always first on every class roll. It’s not fair!” Page said.

“Hey, I can’t help that,” Jack answered. “But I do know I’ll easily get the best grade in the class on my report,” he bragged.

“Oh yeah?” Page **challenged**. “I bet I’ll do better than you even though my tribe is less known.” She wasn’t sure if she could do this or not. She hated to let Jack brag without putting up a fight.

“You think so?” Jack answered. “Then let’s make a bet.”



"You're on," Page countered. "Let's bet a banana split at Homer's Ice Cream Shop. The loser has to buy. That will be you, Mr. Alba!"

Chapter 3

Page knew that she would have a hard time finding information on the Makah; so she began **researching** the very next day. She asked her mother to take her to the huge downtown public library after school.

For a moment Page was in shock. The main floor of the library looked as big as a city block. People were scattered at tables and desks, and there were stacks and stacks of books stretching off into the shadows; a huge staircase led up to other floors.





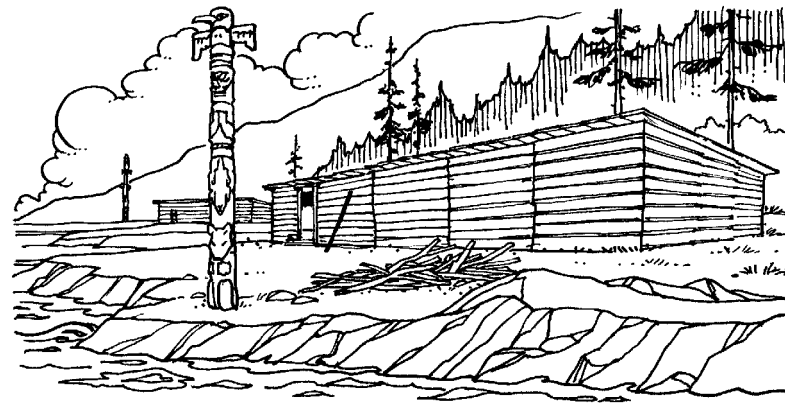
Then Page remembered Mr. Lee's advice about researching in a library: "Always look for the reference desk. The librarian can answer most of your questions."

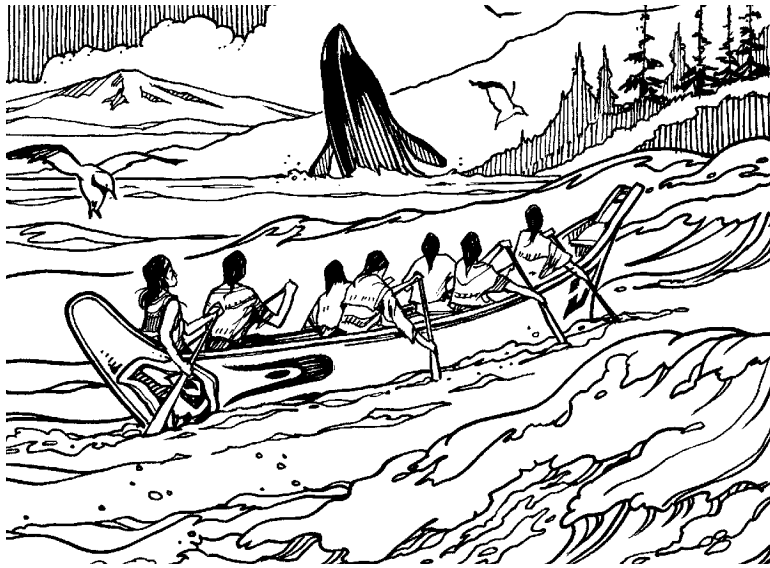
Sure enough, the librarian was able to help her. Page soon had five books on the Makah. With her arms full, she headed to a desk in a quiet corner and settled down.

Chapter 4

Page learned that the Makah were small in number, but were very powerful and wealthy. They lived on a peninsula on the Northwest coast of North America, near what is now Seattle, Washington. Their land was covered with thick forest and **surrounded** on three sides by the ocean. Trees, fish, and animals were plentiful, and they supplied all of the Makahs' needs. Groups of families lived together in large houses made of cedar wood. These houses were very long, with many rooms. They were called "longhouses."

The Makah had **permanent** villages along the Pacific Ocean coast. In the summers, they would move to **temporary** camps along the streams and rivers. When they weren't fishing for salmon swimming upstream from the ocean, they would gather berries in the forest.





The Makah were known as skilled whale hunters. They carved giant canoes from the trunks of huge cedar trees—canoes large enough to handle the heavy waves of the ocean. Groups of Makah warriors learned to read the winds and waves of the Pacific Ocean. They used only paddles and small sails when they headed far out of sight of land in search for whales. Hunting whales on the open ocean was very difficult and dangerous. The effort was worth it. One whale could provide enough food, oil, and materials for making tools to supply a village for an entire year. The ability to hunt whales was seen by the Makah as a great test of courage. It was a source of pride for the whole tribe.



Looking up at the clock on the wall, Page finally closed her last book. She gathered her books and headed toward the library entrance to meet her mother. “Wow!” she said to herself. “I can’t wait to tell Jack what I found about the Makah. What a tribe! I bet the famous Mohawk couldn’t hunt whales from a canoe.” Smiling to herself, she added, “Jack doesn’t have a chance in our bet.”

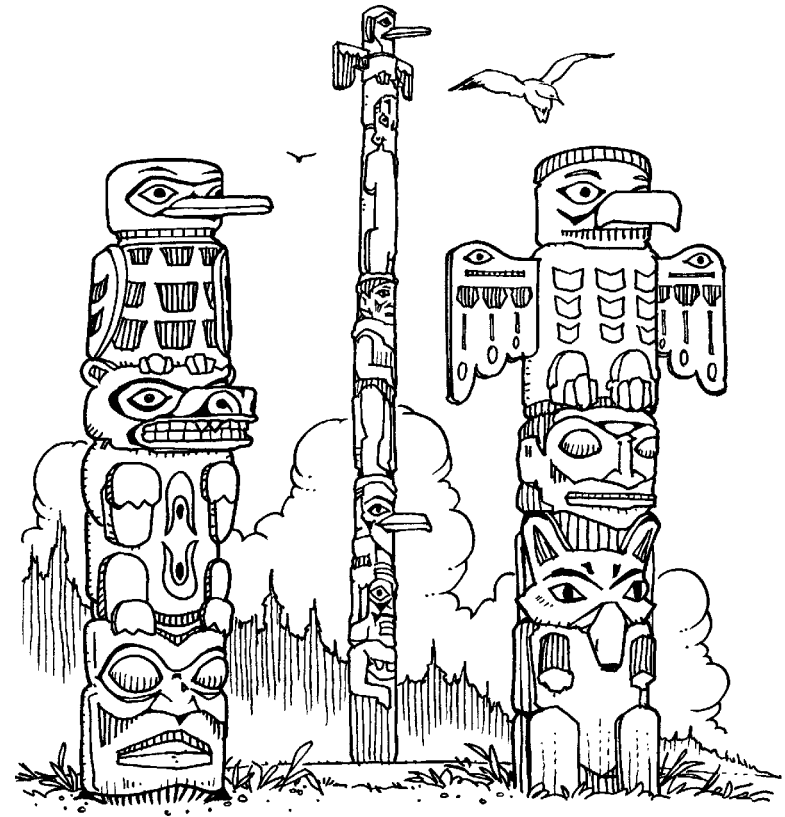
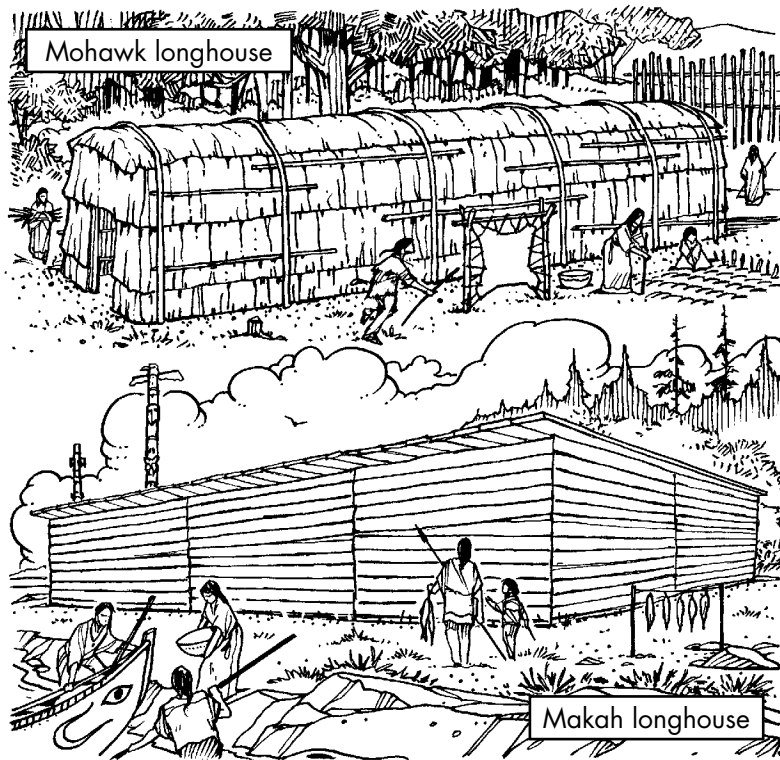
Chapter 5

As soon as Page got home, she called Jack to tell him all she'd learned. "So," Page began on the phone, "I found out so much about the Makah. They lived in these long, wooden houses . . ."

"Called 'longhouses'?" Jack interrupted.

"Yes," Page responded. "How did you know?"

"Because the Mohawk lived in the same type of houses."



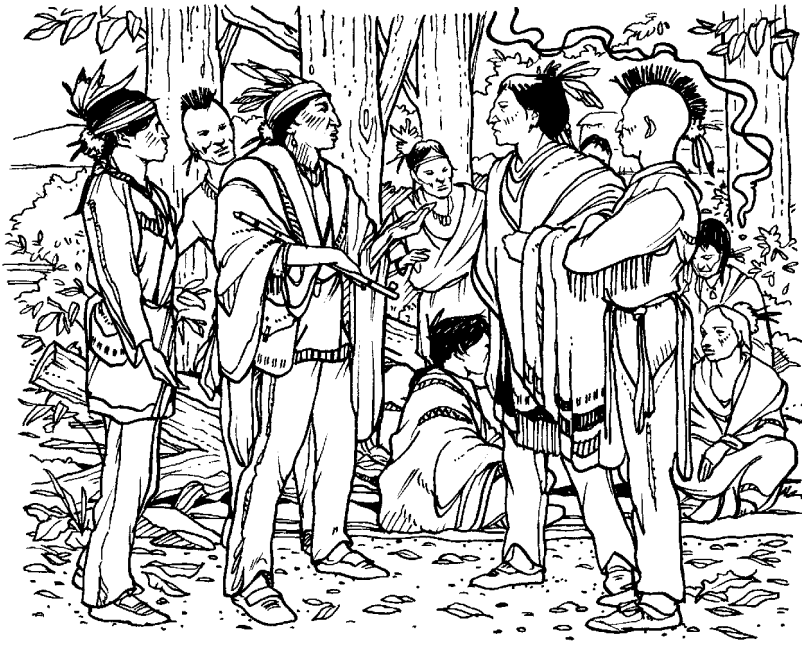
"Well, the Makah carved their family's history into long wooden poles and placed them outside their houses. I bet the Mohawk didn't do that!"

"No, but the Mohawk lived along the streams and rivers in the summer," Jack said, "to fish for salmon swimming upstream from the ocean."

"Oh," Page answered, surprised, and a little disappointed that the Makah had so much in common with the Mohawk.

"Well, I bet the Mohawk didn't hunt whales, so what else was unusual about them?" Page asked.

Jack answered, "The Mohawk were one of five separate tribes that joined together, sort of like the 50 states joining to form one country. They became one of the biggest nations, called the League of Peace and Power, in North America. They had a very **complex system** of government. In fact, when the American colonists began forming the United States government, they borrowed some of the League's ideas for the U.S. Constitution."



"So, part of our government is based on the Mohawk government. Wow!" Page answered. "I never knew that. But you know, aside from the Makah hunting whales, and the size and complexity of the Mohawk tribe, they were really very similar to each other."

"I know," Jack answered. "Hey, I have an idea. Maybe we could present our reports together!"

"Yeah," Page answered excitedly. "Even though they lived on opposite coasts, and one tribe was small while the other was part of a large nation, we could show how similar they were."

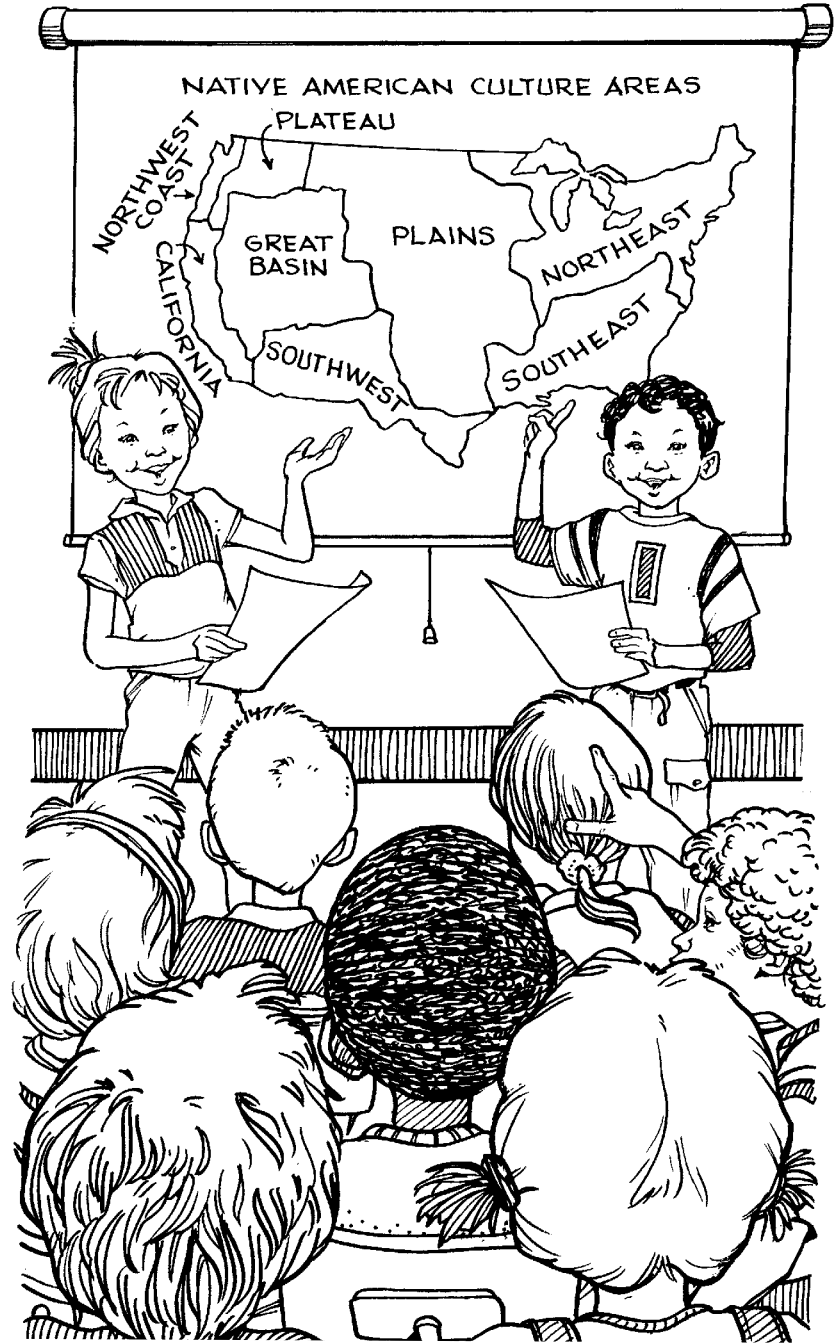
"And then we could finish up with the one big difference for each tribe—the Makah as whale hunters, and the Mohawk with their complex government."

Page thought for a moment. "Hey, what about our bet? If we go together, how do we know who won? Who buys the banana splits?"

The phone was silent for a moment, then Jack answered, "Don't worry. If we do well, I have a feeling it will work out."

Chapter Six

Three days later the research projects were presented at school. All day long, students shared what they had learned about the Native American tribes of North America: The daring horsemanship of the Dakota as they hunted buffalo on the Great Plains; Chief Joseph and the Nez Perce outsmarting the U.S. Army as the Nez Perce tried to escape to Canada; and the giant, stone houses built into the walls of desert canyons by the Ancient Puebloans.

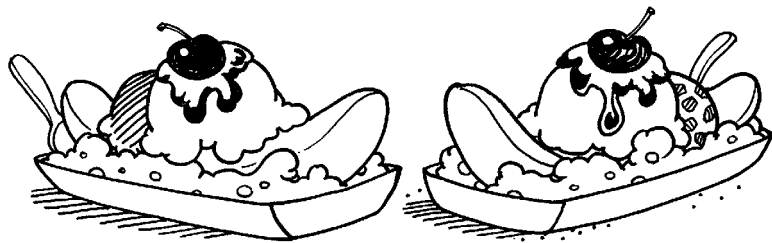


Finally, it was Jack and Page's turn. Mr. Lee had agreed to let them present together. Page looked over at Jack, smiled, and then pulled down the giant map of the United States. Jack stood off to the left side of the map, and Page walked over to the right side of the map. Page began: "Even though these two tribes, the Mohawk and the Makah, lived on opposite coasts, they shared an amazing number of **similarities** . . ."

As Page and Jack finished their report, they encouraged their classmates to research how members of the Mohawk and Makah nations live today. Mr. Lee walked up with a smile on his face.

"Very well done, you two." He turned to the class. "Thank you, all of you. Your reports were excellent! I think we can now all see how amazing these Native American nations are."

Then, with a wink and a sneaky grin on his face, Mr. Lee leaned closer to Page and Jack and whispered, "And, by the way, the banana splits at Homer's, they are on me."



Glossary

challenged	to dare someone to compete (p. 6)
complex	having many different parts (p. 15)
doubts	to be uncertain about something (p. 5)
interesting	something that is curious or attention-getting (p. 5)
permanent	not changing (p. 10)
researching	to explore in depth (p. 8)
similarities	things that are alike (p. 19)
surrounded	to enclose on all sides (p. 10)
system	a group of parts that function as a whole (p. 15)
temporary	open to change; only for a short time (p. 10)

Name _____

INSTRUCTIONS: Draw the information visualized for each tribe in the appropriate section below.

Makah

PAGE'S SCHOOL REPORT • LEVEL U • 1

Mohawk

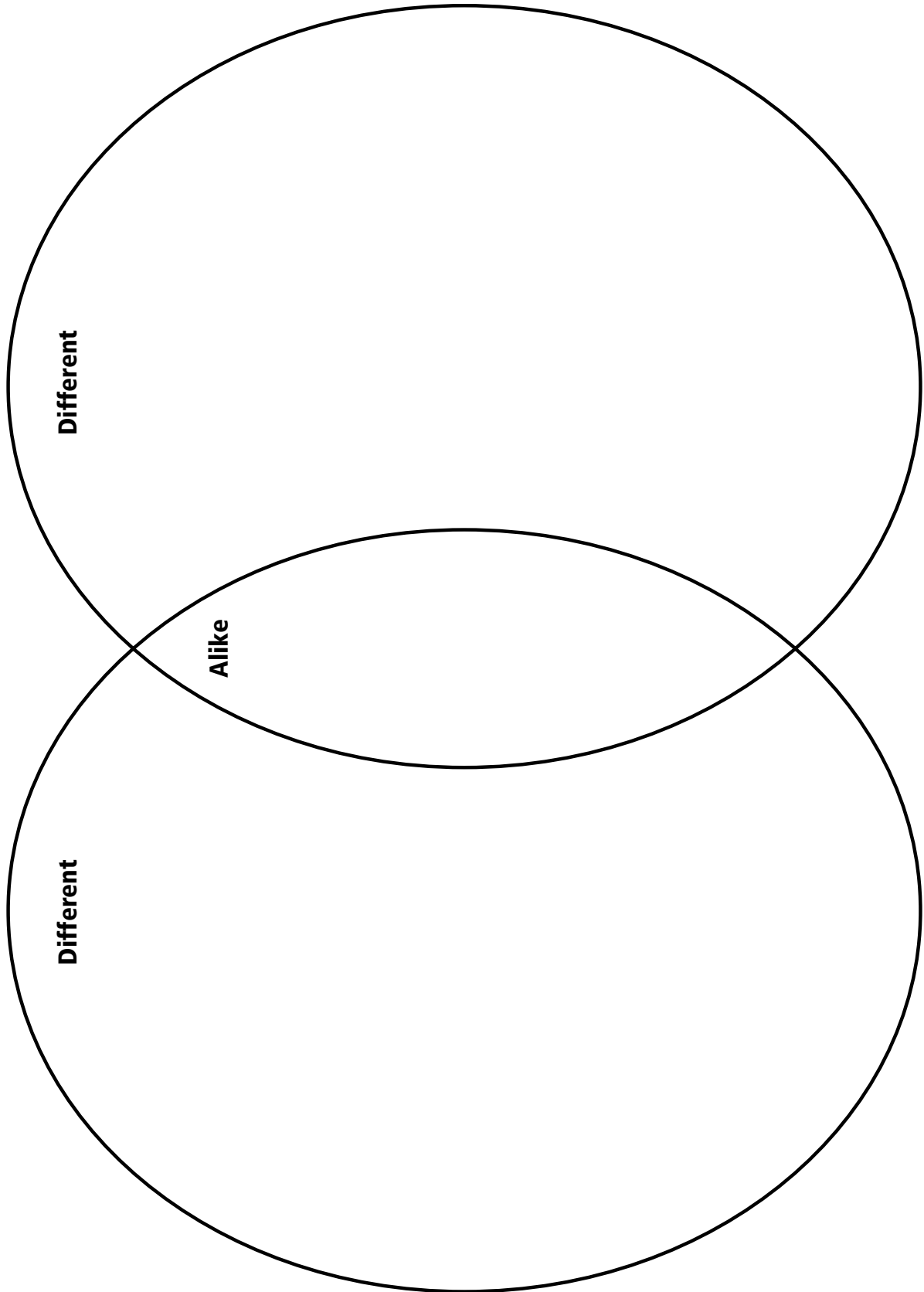
SKILL: VISUALIZE

Name _____

INSTRUCTIONS: Have students write the two topics being compared on the lines below. Then have them write details that tell how the topics are different in the outer circles. Have them write details that tell how the topics are alike where the circles overlap.

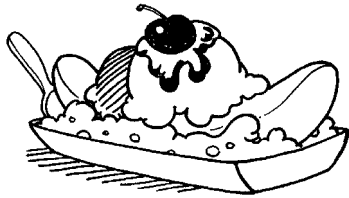
Topic: _____

Topic: _____



Name _____

INSTRUCTIONS: Match words from the left-hand column with words from the right-hand column to create compound words. Write the new words on the lines below.



toe

chocolate

school

banana

seat

high

cough

bulletin

split

board

school

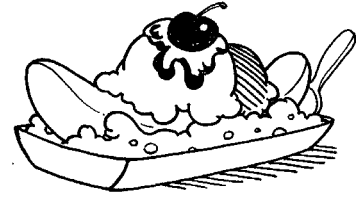
nail

belt

bus

chip

drop



Samson: A Horse Story

A Reading A-Z Level U Leveled Reader

Word Count: 1,908

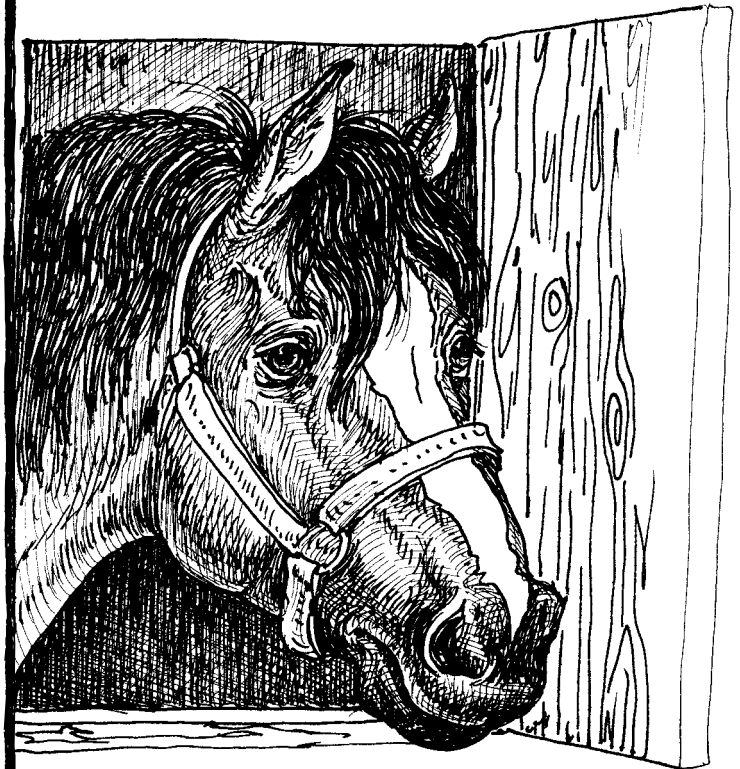



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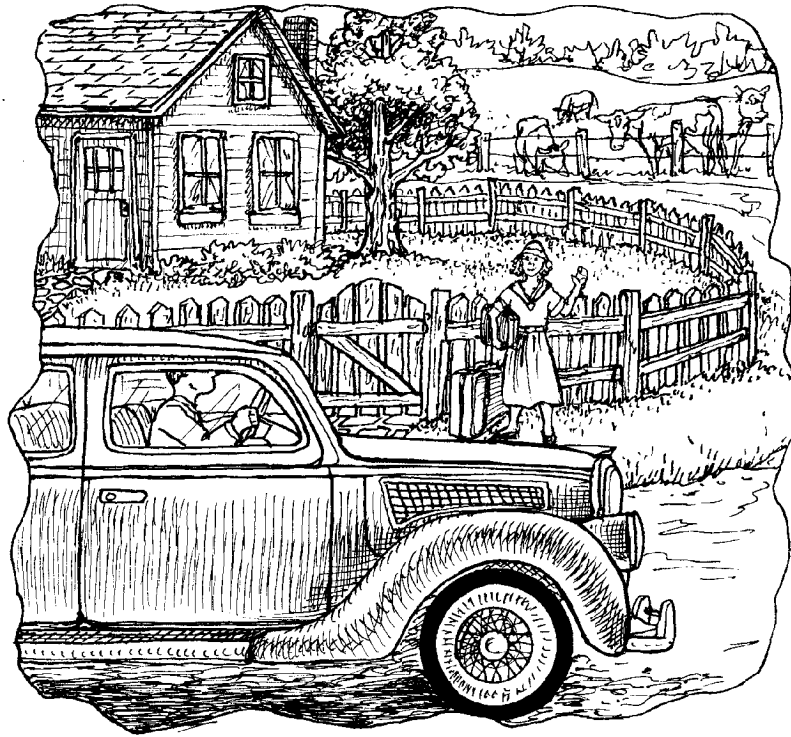
Samson: A Horse Story



Written by Katie Sharp
Illustrated by Roberta Collier-Morales

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Samson: A Horse Story



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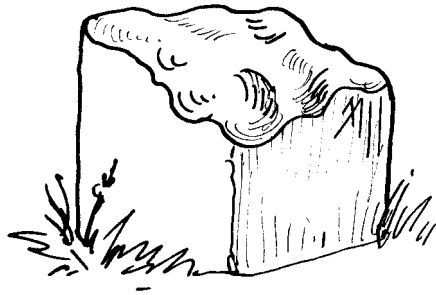


Table of Contents

The Letter	4
Meeting Samson.....	8
Aunt Rita's Journal	12
The Ride.....	15
Leaving Samson.....	20
Glossary.....	24



The Letter

June 4

I can't believe I'm in the back seat of the car instead of at the pool. Who is Aunt Rita anyway? Why would she leave Dad a stinky old farm? It's sad that she died, but this woman, who I had never heard of until today, has ruined my summer.

I wish the letter had gotten lost in the mail. Then Dad would never have known that his aunt left him a farm in Kentucky. Mom and Dad are teachers. What do they know about being farmers?

June 5

I was slipping down the pool slide when I smelled something horrible. Then I saw it. The pool was filled with cow manure! I tried to stop, but I couldn't, and just as my toes were about to slip into the pool, I woke up. Whew, it was just a dream, but then the smell hit me hard. I sprang up in my seat. We were turning into the farm's driveway. I plugged my nose and tried not to breathe.



A man and a boy dressed in overalls waved to us from the front porch. The boy looked a few years older than me. Dad said that Mr. Winn and his 15-year-old son, Henry, would be showing us around the farm. All I wanted to do was go to bed. I grabbed my suitcase and walked inside.

Mom said I could have first pick of the bedrooms, so I dragged my suitcase up the stairs. There were three bedrooms. I chose the one that faced away from the farm. Maybe, I thought, that would help me forget where I was.

June 7

I can't believe how slow time passes around here. I've never been so bored. I miss the pool. I miss my friends. I'd rather be at school than here on this stinky old farm. I'm avoiding Dad. He's mad at me because I'm not helping out. It's *his* farm; let him do the work!





June 9

Dad yelled at me at dinner. He said I'd best stop feeling sorry for myself and start pitching in. I refused to look at him because I didn't want him to see me crying. I just stared at my plate.

Dad said, starting tomorrow morning, I have to help Henry tend to the animals. "Tend to" the animals? Dad acts like he really *is* a farmer.



Meeting Samson

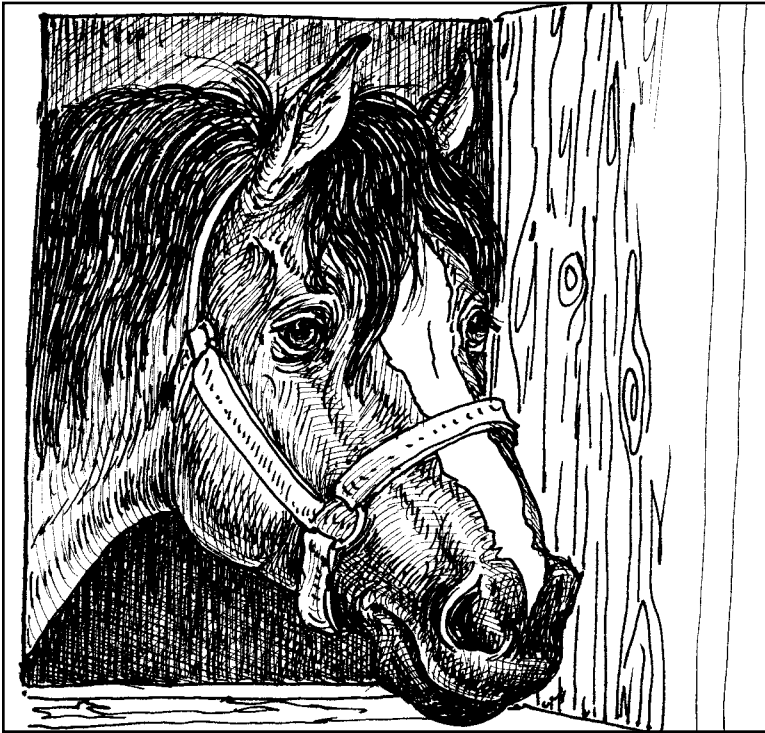
June 10

Mom woke me at five this morning so I could meet Henry at six. Why do farmers wake up so early?

Henry was working in the barn when he saw me. He waved hello and said he had heard I wasn't too eager to help out, so I could just follow him around and watch. At least Henry understands me.

I trailed along as Henry cleaned out the chicken **coop**. It was disgusting! When he was done, Henry collected some eggs and dropped them gently into a basket. They were all different colors—not like the eggs at the supermarket back at home.

Then we headed to a small barn. Henry opened the top half of the door, and much to my surprise a reddish-orange horse poked its head through the door. A thick, white stripe split its face in two. I didn't know Aunt Rita had a horse.

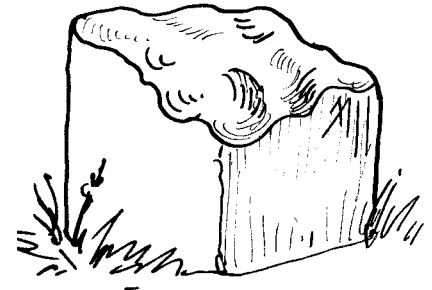


Henry introduced me to Samson and asked if I liked horses. I lied and said I thought they were okay. Actually, I don't like them and can't understand why so many girls my age do. I watched as Henry opened the bottom half of the door and led Samson to a fenced area.

He said that Samson liked to **graze** on grass during the morning, and that we would come back later and feed him some oats. He fetched a hose and brought it to a big metal **trough**, which he filled with water.

As he walked back with the hose, he tripped over a big, white block. He asked if I knew what it was. I didn't really care. He said it was a salt block and that horses need to lick salt blocks because they lose a lot of salt when they sweat.

Then Henry accused Samson of moving the salt block so he would trip on it. "Maybe he's mad because Rita died," he added. Then he grabbed a brush and began stroking the horse with it. He talked quietly to Samson as he **groomed** him. Samson didn't seem mad to me.



June 17

I've been helping Henry for a week now—even on the weekend. We talk a little every day. He told me that his dad and Aunt Rita were friends and that Mr. Winn helped her with the farm. But she took care of most of it by herself, which is pretty incredible since she was in her 80's when she died. Henry said he was going to miss her. He also mentioned that Aunt Rita's house is probably full of interesting old stuff.



June 18

It rained this morning, but I still had to do my chores! What a disgusting mess! Mud was everywhere, and the manure smelled worse than ever. Mom said it might rain all day. I remembered what Henry said—that there was probably interesting stuff in Aunt Rita's house. I think I'll snoop around today.



Aunt Rita's Journal

June 19

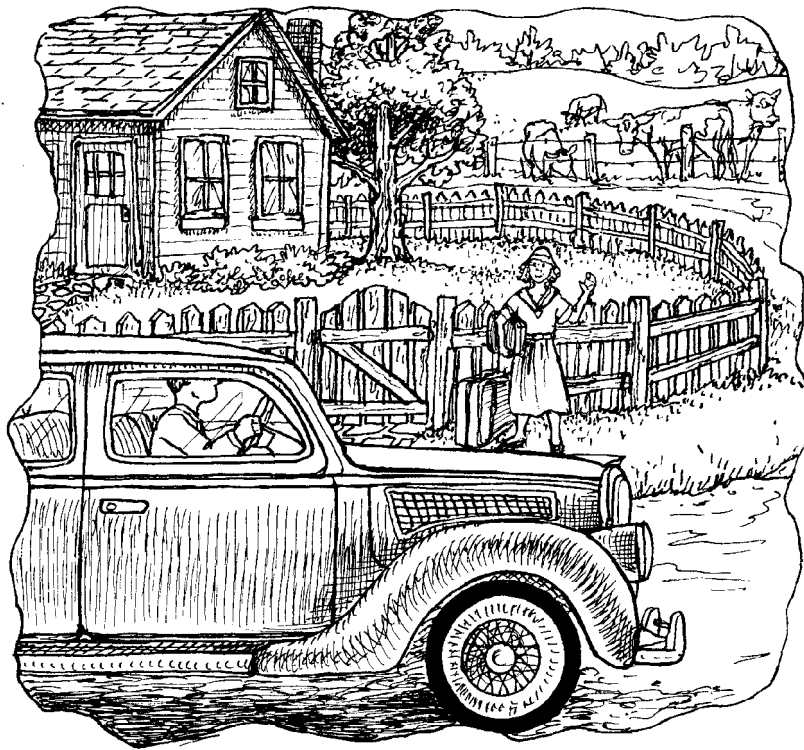
I didn't want Mom to catch me snooping, so I started in my bedroom closet. It was filled with cool stuff. I found a faded blue book that was sticking out from underneath an old box. I opened the cover and read the words "Dear Diary." I had found a journal.

I started to read, and then stopped. I wouldn't want anyone reading my journal. But I decided Aunt Rita would probably want us, her family, to know more about her.

June 20

I spent all day reading the journal. It was like reading a really good book. Aunt Rita started writing when she was 12, after her mom died. She thought writing might ease her sadness. Her dad had to work, so he left her with neighbors who lived on a farm. She hated the smell of the farm and wished she could stay home by herself.

When Mom called me to dinner, I couldn't believe how long I'd been reading.



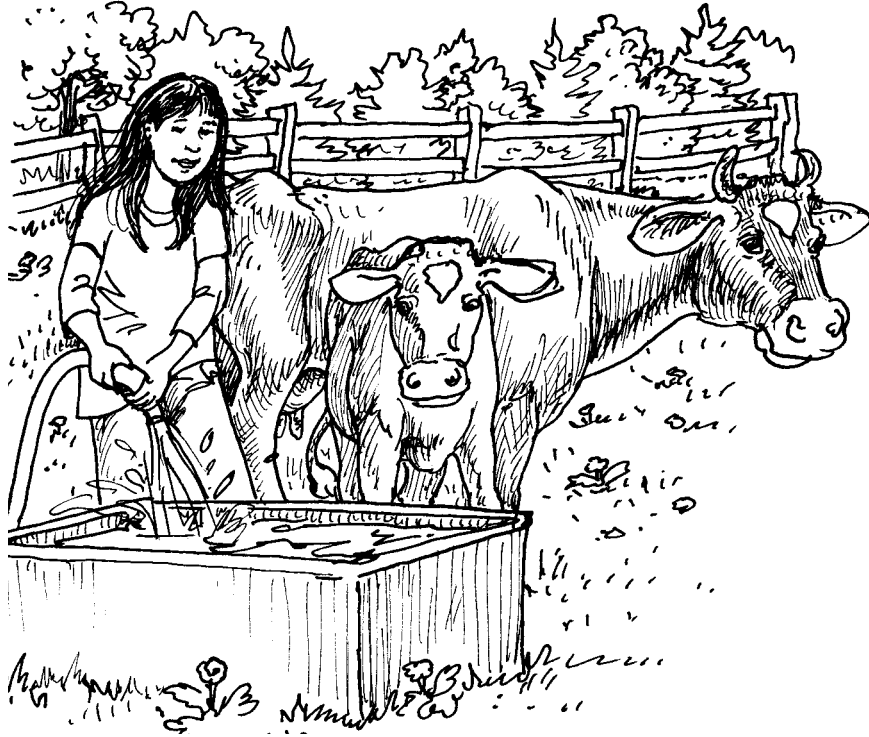
June 21

I know why Aunt Rita named her horse Samson. According to her journal, she liked a boy named James Samson who worked on the farm. She liked to watch him, but she was too shy to talk to him. One day he asked her if she wanted to ride one of the horses. She didn't like horses, but she agreed because she wanted to be friends with James.

She rode a reddish-orange horse named Jack. He had a white stripe down his nose, just as Samson does. Rita was nervous about riding, but she trusted James. She wrote all about her first ride in her journal. It seemed to change her. Riding horses couldn't bring her mom back, she wrote, but now she had something to look forward to each day.



Mr. Winn and Henry had dinner with us tonight. After dinner I asked Henry if I could ride Samson tomorrow. He said yes!



The Ride

June 22

When I got to the barn, I started helping Henry right away. I think he was surprised because I usually don't help much. I just wanted to finish the chores so we could ride.

As we headed to Samson's stall, I realized how much I had learned about taking care of farm animals. I've even gotten used to the smell. Henry asked why I had changed my mind about riding Samson. I didn't want to tell him about Aunt Rita's journal. He might not think I should be into her private things, so I told him I was bored instead.

When Henry opened the barn, Samson looked different to me. He seemed handsome. His colors were brighter. I think he even smiled at me. Henry put Samson's saddle on and dragged a stepladder next to his side. I climbed on. Henry guided my left foot into the **stirrup** and then helped me swing my right leg up and over Samson's back.

Henry gave me a few pointers about how to ride before he led me and Samson out to the **pasture**. I held onto the **reins** and the **saddle horn** with all my might as we walked along.

Riding a horse was just as Aunt Rita had described it—a little scary, but also very exciting. I kept thinking: *What if I fall? What if Samson starts galloping? What if he tries to throw me off?* Yet he was so gentle. I couldn't believe I was riding a horse and liking it. I couldn't believe I was having fun!

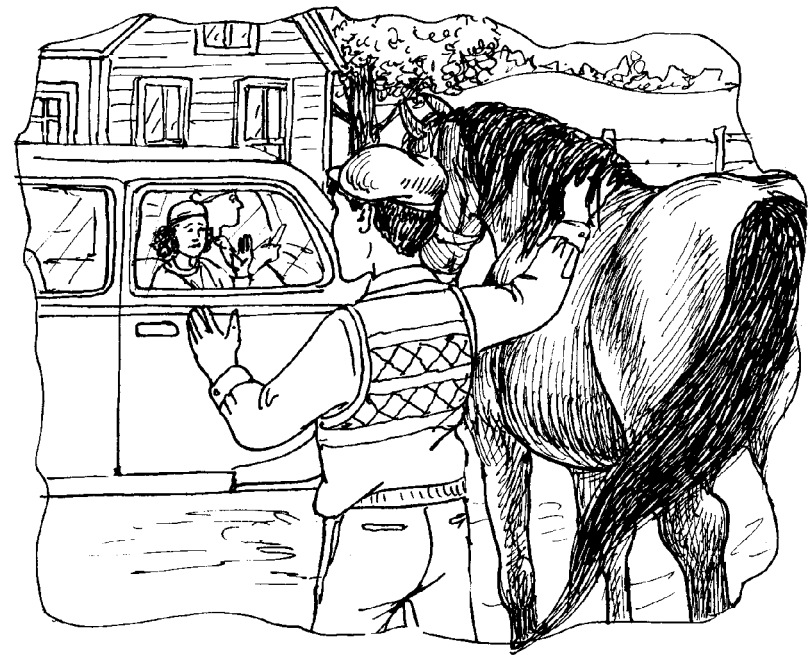


June 26

I spent the last few days taking riding lessons from Henry. But it rained today, so I read more of Aunt Rita's journal.

About six months after Rita started riding Jack, her dad announced that they were moving back to New York City. He was too sad living in the town where Rita's mom had died. Rita was sad too—and mad. She didn't want to leave James or Jack. After losing her mom, she couldn't believe she was losing everything else too.

That's how her journal ended.





I wanted to find out more about Aunt Rita. I asked Mom if the Winns could come to dinner. That's when I told them about the journal and how it ended. Mr. Winn explained that Rita never forgot Jack, and as soon as she was able she moved back to the country and bought herself another horse. And in her eighties, she was still quite the rider.

I wanted to know why she left the farm to Dad. Mr. Winn smiled and said that Aunt Rita knew about me, and she knew I was the only young girl in the **family tree**. She wanted a young girl to look after Samson.

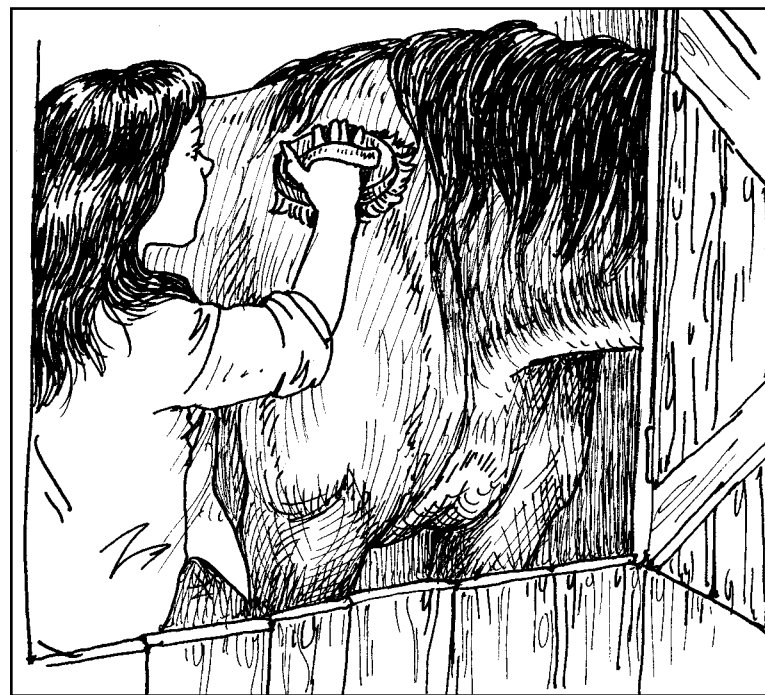
Then Dad said we needed to discuss what would happen to the farm when it was time to go back home.

Leaving Samson

June 27

Dad is actually considering selling the farm. And he says if he does sell it, he'll sell everything along with it, including Samson. He says he's just not ready to own a farm because it's too much work.

I told him that I wouldn't let him do it! After all, Samson is mine. Aunt Rita wanted me to have him. I love him. There is no way that I'll let Dad sell him.





July 1

Mr. Winn came by to see Dad and Mom last night. He offered to take care of the farm during the school year, while we're away. Dad said he'd think about it. I hate it when he says that!

July 7

It's a done deal! Dad agreed to keep the farm. He hired Mr. Winn to run it for us. I've never been so happy. As soon as I heard the news I ran out to tell Samson. I think he understood.



July 18

I can't believe I have to go home. Mom and Dad need to get their classrooms ready for the new school year. I'm sure going to miss Mr. Winn, Henry, and everything about Aunt Rita's house. But most of all, I'll miss Samson. I can't wait to get back to him and that old farm, even if it is a little stinky.

Explore More About Horses

Horses are mammals. They belong to the *Equus* family—the same family as zebras, mules, and donkeys.

Horse Talk

foal	a baby horse
yearling	a horse between one and two years old
colt	a male horse under three years old
filly	a female horse under three years old
stallion	an adult male horse
mare	an adult female horse
pony	a full-grown small horse

A mare carries her baby for 11 months. Most mares give birth in the spring to one baby, but twins are not uncommon. It takes three to four years for a horse to fully mature.

Horses generally live to be between 20 and 25 years old, although they can live for up to 30 years. The oldest recorded horse was Old Billy, an English barge horse, who lived to be 62 years old.



Glossary

coop	an enclosure in which chickens are kept (p. 9)
family tree	a chart that shows the relationship of family members over generations (p. 19)
galloping	moving forward in a fast, rhythmic way (p. 16)
graze	to eat grasses and plants in a field (p. 10)
groomed	cleaned or brushed (p. 10)
pasture	grass-covered land used for grazing livestock (p. 16)
reins	straps by which a horse is controlled (p. 16)
saddle horn	a knob on the front of a horse's saddle (p. 16)
stirrup	a ring with a flat bottom hung by a strap, usually on each side of a saddle (p. 16)
trough	a long narrow container that holds feed or water for animals (p. 10)

Name _____

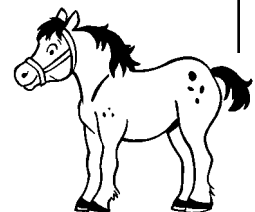
INSTRUCTIONS: Reread one chapter of *Samson: A Horse Story*. Use the top box to record the important information in your own words. In the bottom box, use the information you wrote to summarize the chapter in paragraph form.

Important Information from Chapter: _____

SAMSON: A HORSE STORY • LEVEL U • 1

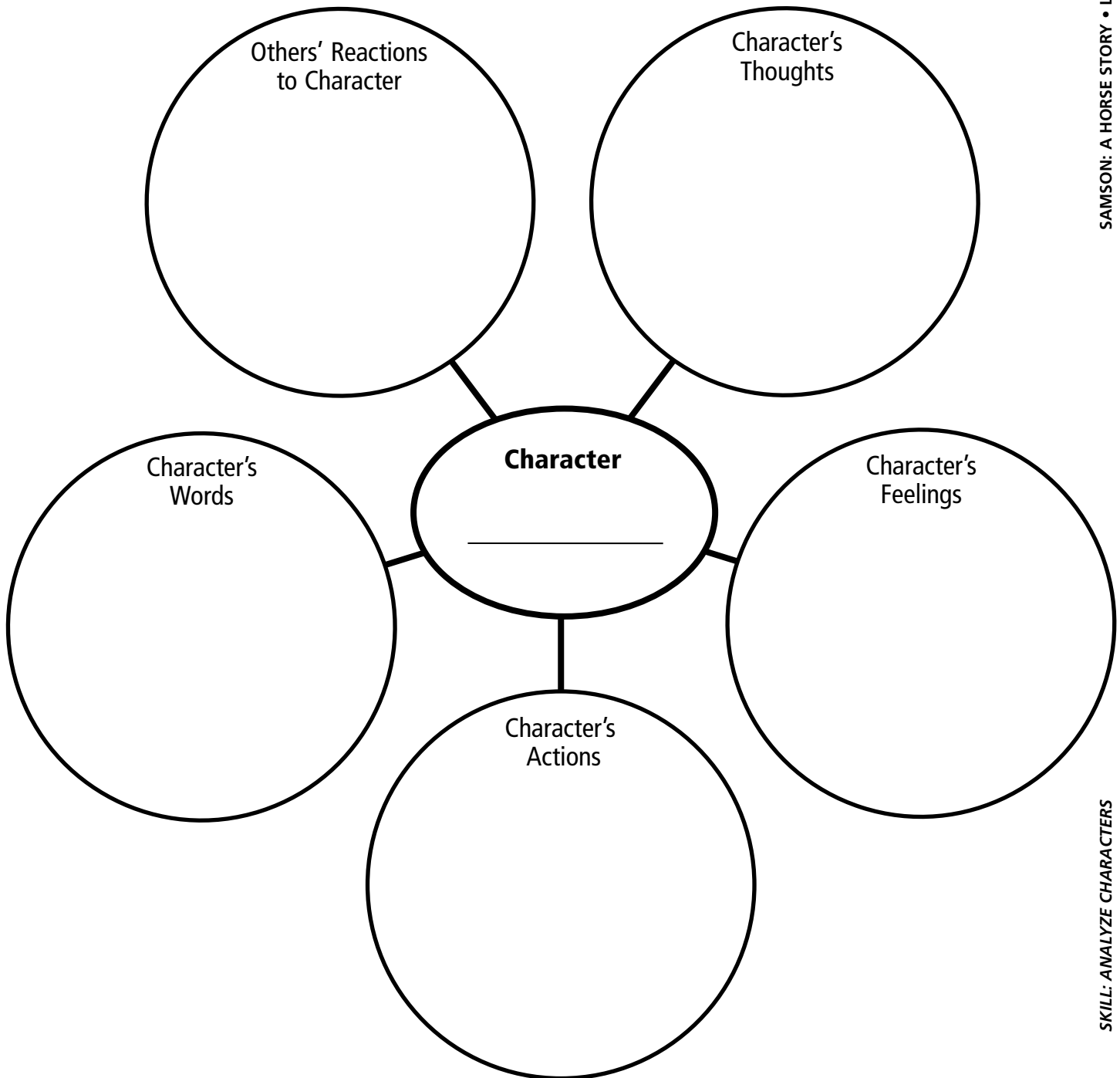
My Summary of Chapter: _____

SKILL: SUMMARIZE



Name _____

INSTRUCTIONS: Write the character's name in the center circle of the web. Tell more about the character's thoughts, feelings, actions, etc., in the remaining circles.



Name _____

INSTRUCTIONS: Read the pronouns in the word box. Then read each sentence. Replace the underlined word or words in each sentence with a pronoun from the word box. Write the new sentence on the line.

they	her	she
he	it	we

1. Dad bought pizza for dinner.

2. I wanted to learn more about Aunt Rita.

3. I spent all day reading the journal.

4. Mom and Dad wanted me to help out around the farm.

5. Henry and I went riding every day after that.

6. My dad's aunt was pretty cool, after all.

Microbes: Friend or Foe?

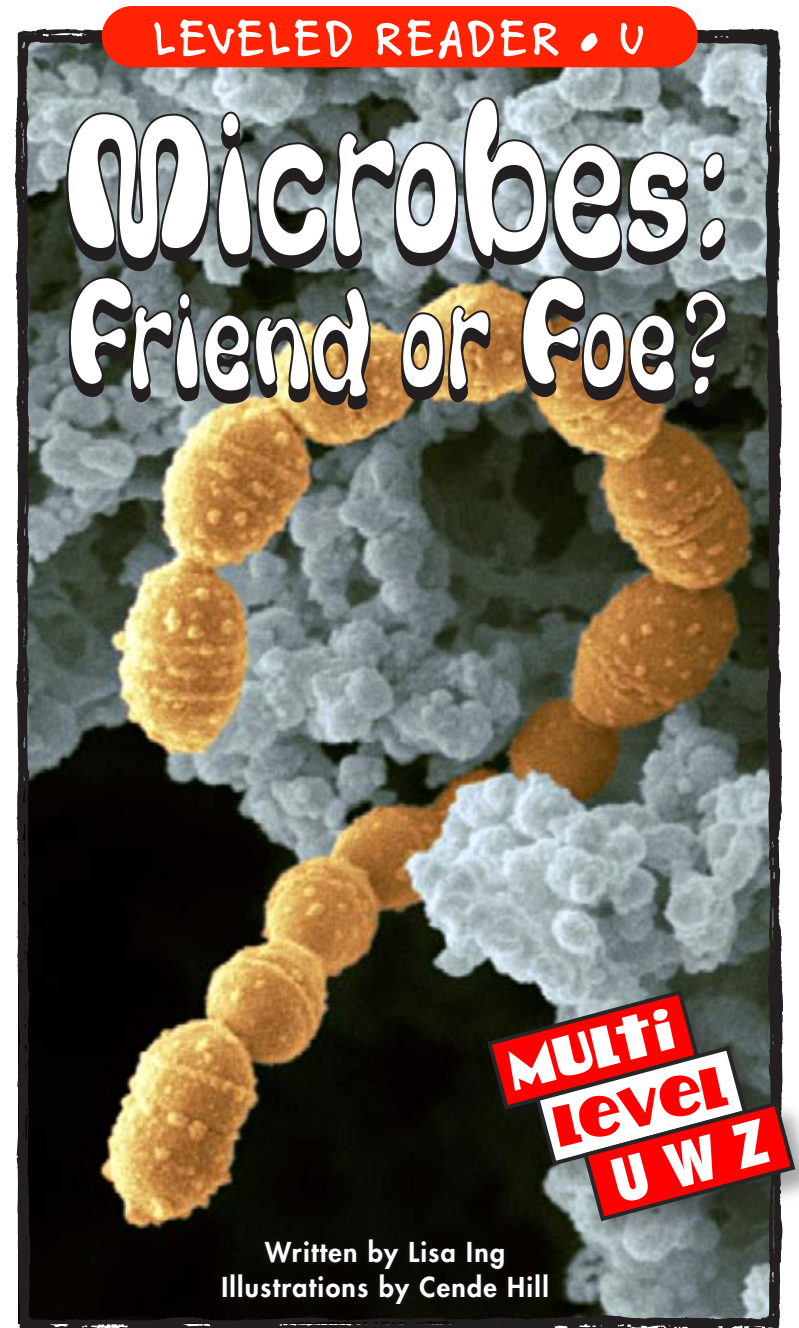
A Reading A-Z Level U Leveled Reader

Word Count: 1,658



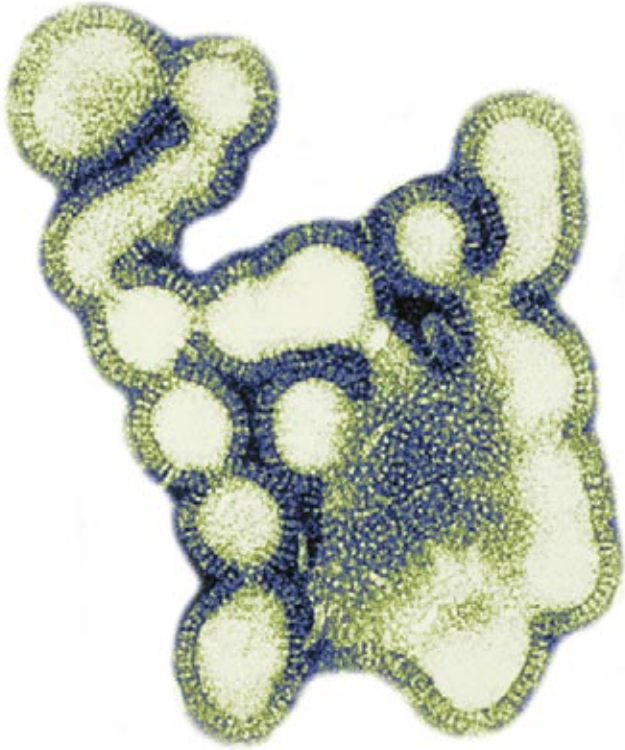
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Microbes: Friend or Foe?



Written by Lisa Ing
Illustrations by Cende Hill

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LEVEL U	
Fountas & Pinnell	Q
Reading Recovery	40
DRA	40



Table of Contents

Introduction	4
What Are Microbes?	5
The Immune System	7
Four Groups of Microbes	9
<i>Bacteria</i>	9
<i>Viruses</i>	11
<i>Fungi</i>	13
<i>Protozoa</i>	13
How Do Microbes Spread Infection?	14
Outbreaks and Epidemics	15
Fighting Microbes with Vaccines	16
Antibiotics: The Magic Bullet	19
Conclusion	22
Glossary	23
Index	24

Introduction

Achoo! You sneeze. You cough. You're tired. Your throat hurts. You know you're getting sick—but why? You might be sick because of a tiny microbe—a *germ*.

Long ago, no one knew what made us sick. No one had studied **disease** and health. Many people imagined they were cursed, or being punished for something. Now, we know that some microbes, or germs, can cause disease. But what are microbes? Where are they? Are all microbes bad? Can learning about microbes help us stay healthy?

Do You Know?

George Washington, first president of the United States, caught a throat infection in 1799. His doctors did a common treatment at the time called bloodletting. They took nine pints of blood from his body in one day. The human body holds only 12 pints of blood. Sadly, Washington died from the treatment, not the disease.



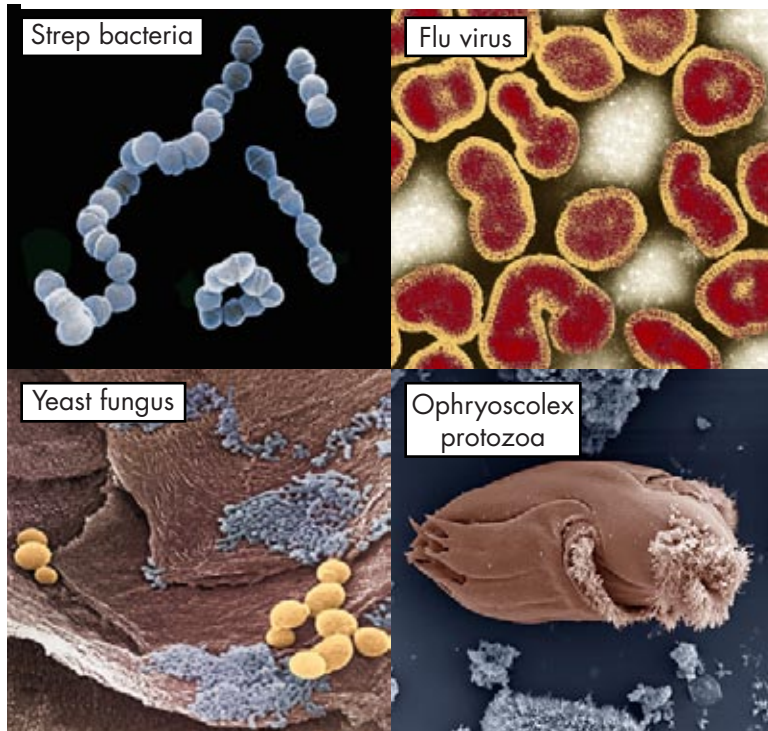
Doctors used leeches in bloodletting.

What Are Microbes?

Microbes are tiny, living **organisms**. We need a strong **microscope** to see them. Microbes live all around us. They are in the air we breathe. They sit on everything we touch. They are on our skin and shoes. Many live inside our body. They are everywhere!

Some microbes are good for us. They help protect us from disease. Other microbes are harmful. Harmful microbes can make us sick.

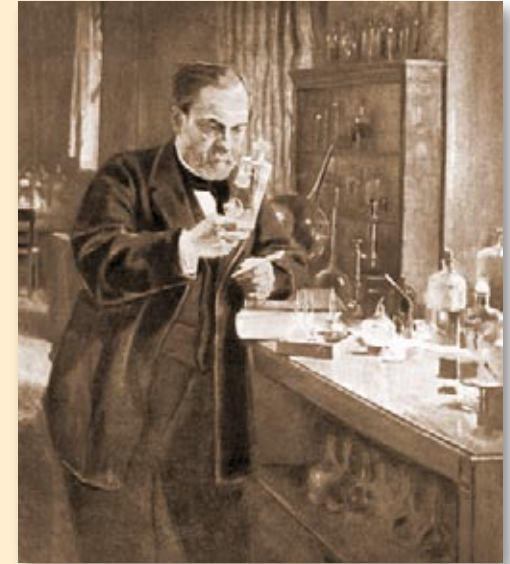
Different kinds of microbes



Louis Pasteur

Modern medicine owes a lot to Louis Pasteur (PASS-toor). He proved the Germ Theory of Disease, which states that contact with harmful microbes is the cause of disease.

Pasteur's most important discovery was that heating a sealed canister filled with food to a specific temperature for a certain length of time would kill many organisms inside. This heating process is called pasteurization. Today it is used on fresh milk and canned food.



Math Minute

To pasteurize milk, the milk is heated to 145 degrees Fahrenheit (62.8°C) for 30 minutes, or to 163 degrees Fahrenheit (72.8°C) for 15 seconds. How much quicker in seconds is it to pasteurize milk at the higher temperature?

$$1 = 3 + 5 + 2 = 10 - 4 + 10 \div 2 = 14 \times 2 - 3 = 25 - 5 = 5$$
$$5 \times 2 = 17 + 3 \times 2 - 20 \div 2 = 1$$
$$1 = 3 + 5 + 2 = 10 - 4 + 10 \div 2 = 14 \times 2 - 3 = 25 - 5 = 5$$

The Immune System

Our **immune system** is like our bodyguard. It protects us. It's made up of our body's important **cells**, tissues, and glands. The parts of the immune system work together as a team. The team's job is to protect us from **infection** and disease.

Math Minute

Some microbes can double their population every 20 minutes. If you start out with 1 microbe, how many microbes will you have after 4 hours?

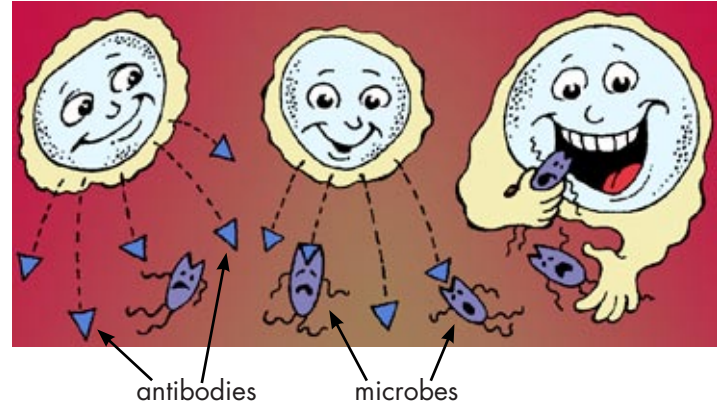
Hint: Start with 1 microbe at 0 minutes.



On the outside, our skin is a shield for our whole body. Inside, our strong, white blood cells travel in our blood, looking for harmful microbes. They kill millions of harmful microbes every day. Harmful microbes can damage our body's important cells. They spread an infection from cell to cell, making us sick.

Do You Know?

One drop of blood contains between 7,000 and 25,000 white blood cells. These cells attack invading microbes in different ways. Some white blood cells produce antibodies that cancel out the microbe's chemicals, while others surround the microbe and destroy it.



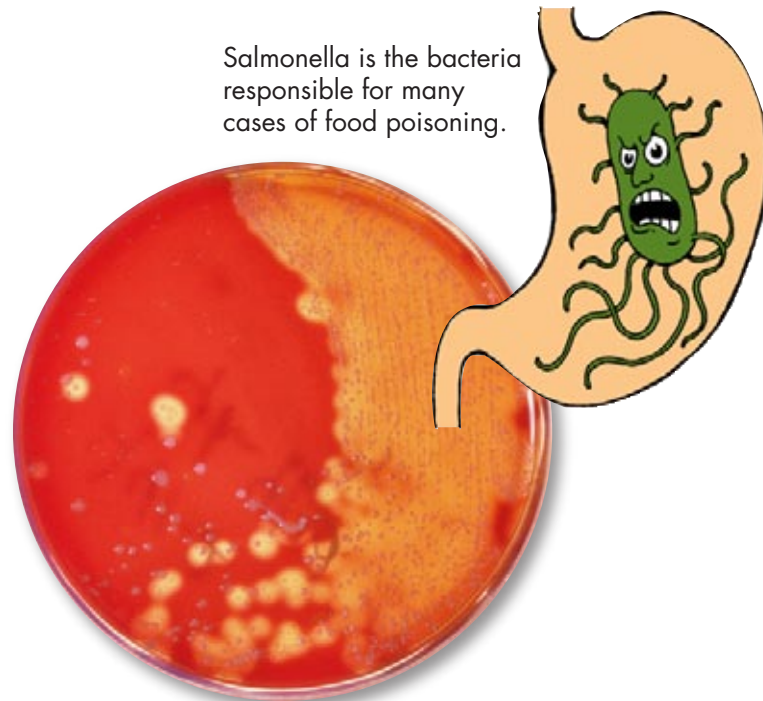
Our body's cells join together like building blocks to help us grow. We have blood cells, bone cells, stomach cells, skin cells, and muscle cells. To protect these cells, the immune system tries to keep out the troublemaking microbes.

Our immune system's best weapon is its great memory. It remembers which microbes are good and which are bad. It recognizes and remembers harmful microbes it has seen before. It remembers how to fight them off if they ever come back.

Four Groups of Microbes

Bacteria

Bacteria (back-TEER-ee-uh) are tiny, simple organisms. Bacteria are everywhere. One good type of bacteria lives in our intestines. It helps us digest the food we eat. Other, harmful, bacteria cause infections. Strep throat and food poisoning are infections caused by harmful bacteria. Strep throat bacteria can cause a very painful, swollen throat and a fever.



Salmonella is the bacteria responsible for many cases of food poisoning.

Scientists sometimes grow bacteria on purpose so that they can study them. Here, strep throat bacteria grow in a dish filled with a liquid that provides food and a safe environment.

The bacteria that cause food poisoning live on many uncooked foods. Cooking foods to the right temperature kills bacteria. But disease-causing bacteria also live on kitchen countertops and on our hands. We should wash our hands with soap before we touch food. Food poisoning can cause an upset stomach, vomiting, and diarrhea.



Fun Food Fact

Several types of bacteria help change milk into yogurt and sour cream. These bacteria eat **lactose**, or milk sugars, and release lactic acid, which curdles the milk and makes it more solid. The lactic acid gives yogurt and sour cream a tangy, sour flavor.

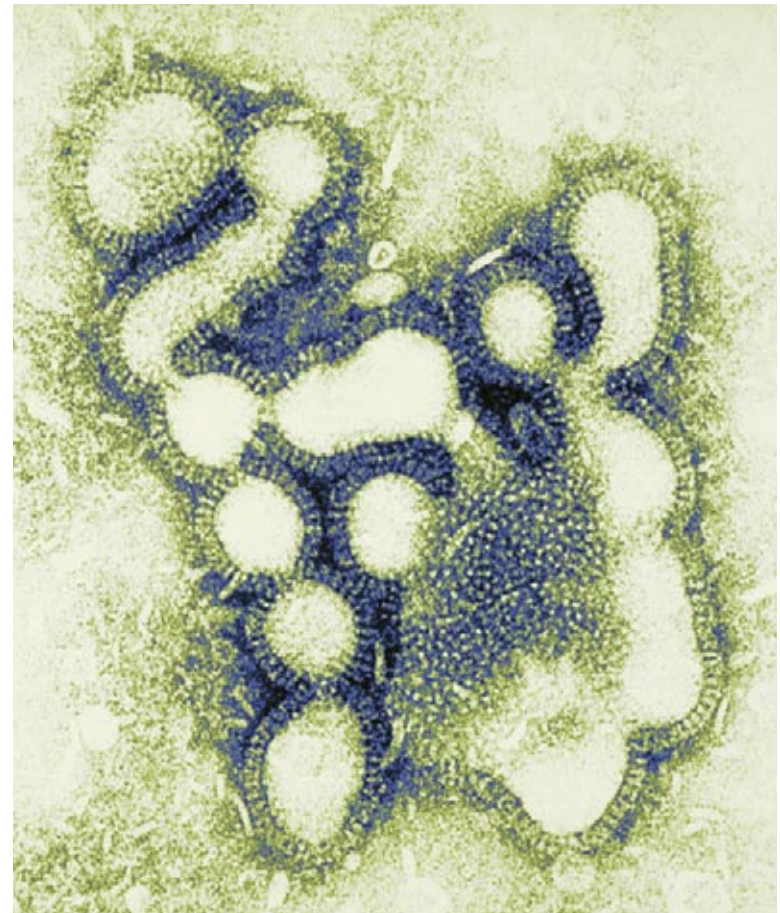
Viruses

Viruses (VY-russ-es) are even smaller than bacteria. A virus gets inside the cells of people or other animals. Then, they spread an infection from cell to cell.

Do You Have a Common Cold or the Flu?

Symptoms	Common Cold	Flu
Headaches	No	Yes
Fever	None or Mild	High Fever, 102–104°F for days
Muscle Aches & Tiredness	Sometimes	Yes
Sore Throat	Yes	Sometimes
Runny Nose	Yes	Sometimes
Sneezing	Yes	Sometimes
Coughing	Yes	Yes
Chills	No	Yes

A viral infection can make you very sick. Some viruses can cause death. A virus is able to **mutate**. It can change its identity—like putting on a mask. That can make it harder for our body to recognize the virus and fight it off. Viruses cause diseases like the flu, chicken pox, and the common cold.



Influenza virus at 295,000x magnification



Mosquitoes can transfer diseases like malaria and West Nile virus from person to person.



Athlete's foot is caused by a fungal infection of the skin.

Fungi

Like other types of microbes, most types of harmful fungi are almost invisible. Two infections caused by harmful fungi microbes are ringworm and athlete's foot. Ringworm causes a raised, itchy, red ring to appear on the skin. Athlete's foot attacks the bottom of feet and the skin between the toes. It makes the skin itch, crack, and peel.

Protozoa

Protozoa (pro-toe-ZOE-uh) are also tiny, simple organisms. They often live in streams, ponds, and dirty water. Be careful about the water you drink. If protozoa get into your body, they can cause vomiting, diarrhea, and mouth infections.

One dangerous protozoa is spread by the bite of an infected mosquito. It causes a serious disease called malaria. Malaria kills a million people every year.

How Do Microbes Spread Infection?

Infections can spread easily. Many microbes that cause infections live in body fluids. These fluids include saliva, blood, and nasal mucus. Microbes in body fluids can be spread when a person blows his or her nose or coughs. The microbes are now on the person's hands. If we touch the person's hand, we pick up the germs. Coughing also puts germs into the air. We can breathe in those germs. Sometimes we touch something that the sick person has already touched. What he or she touched is **contaminated** with the germs on his or her hands.

There are also a few diseases that can pass from an infected insect or other animal to a person. Some come from infected dogs, raccoons,



Tissues help keep germs from spreading.

and skunks. Bacteria can be on chickens, birds, fish, and reptiles. A type of flu virus comes from sick birds and another infection from tick bites.

Outbreaks and Epidemics

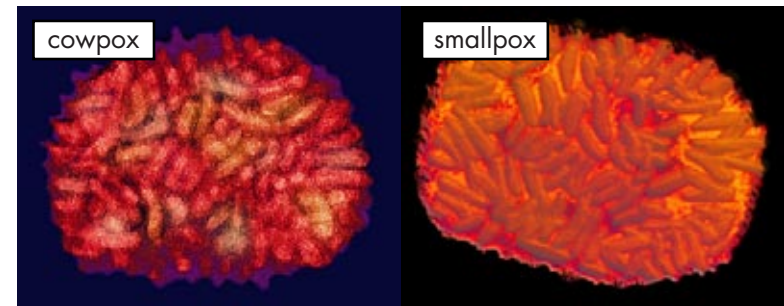
A disease can spread from a few infected people in one place to thousands of people around the world. When a small group of people gets the same disease, it's called an **outbreak**. When an outbreak of a disease spreads to a large number of people, it's called an **epidemic**. When an epidemic spreads to people all around the world, it's called a **pandemic**.

An outbreak of a disease can spread within days. Airplanes, trains, and buses carry both people and their germs quickly. A sick passenger can infect anyone he or she passes during the trip. When another person gets infected, he or she can carry the germs to another place and infect people there. In the United States, there is a disease-watching group called the Centers for Disease Control and Prevention (CDC). The CDC tracks infections around the world.



Fighting Microbes with Vaccines

No one likes to get shots, but they're important. Shots of **vaccines** are given before you get sick. They prevent a disease from starting. The job of a vaccine is to help our immune system learn to fight off a harmful microbe. Most vaccines are made from weak bits of a virus or bacteria. The immune system learns about that virus microbe from the small amount in the vaccine. It learns how to fight off the real virus. Remember that the immune system has a great memory for microbes.



Do You Know?

When Europeans and Africans carried *smallpox* microbes to the Americas, none of the Native Americans had ever been exposed to the disease. They had no immunity to it. As a result, smallpox killed millions. In South and Central America, nine out of ten people in the largest native cities died from smallpox.



The idea of using a virus to fight itself, or for one disease to fight another disease, isn't new. It was first thought of about 200 years ago, in England. Dr. Edward Jenner treated many cases of cowpox, a mild pox disease often caught by farm workers. He also treated many cases of deadly smallpox. Epidemics of smallpox killed thousands of people each year. There wasn't a cure for it. Over time, he noticed that anyone who had first caught cowpox never got the deadly smallpox virus later. But why?

He realized that the two pox diseases must be related to each other. Maybe they were like cousins in a family. But how could he test his idea that one virus could be used to stop another virus?

Dr. Jenner wanted to find out why, or how, this happened. In his test, he gave a group of healthy people a mild case of cowpox. The cowpox made them feel slightly ill for a while. But while they were sick, their immune system was learning about that pox virus. It built up a defense against the pox microbe. It remembered how to fight off that microbe. His idea worked. He used one mild disease to fight off a similar, more dangerous, disease. The people in the cowpox test never caught a deadly smallpox infection. People could be protected. Smallpox was destroyed.

Dr. Jenner's idea of trying to prevent the spread of a disease saved thousands of lives around the world.



About seventy-five years later, Louis Pasteur discovered how to weaken microbes. Like Dr. Jenner's use of cowpox, his discovery led to the use of weakened microbes to make several types of vaccines. These vaccines could fight specific diseases. They could be made in large quantities, so many people could be vaccinated against a disease at one time.

Almost all children are given shots of vaccines before they start school. A flu shot is a vaccine. Many people get a flu shot every year to prevent a flu infection.

Antibiotics: The Magic Bullet

Scientists discovered that some helpful microbes are natural fighters. These special microbes naturally produce strong medicines called **antibiotics**. *Anti* means “against.” These helpful microbes fight certain harmful microbes and kill them. Antibiotics are very particular and attack only the cells infected by harmful microbes. They don’t harm healthy cells or destroy other, helpful, microbes. Your doctor might prescribe an antibiotic to stop an infection.

Antibiotics work well. But sometimes, a strong microbe fights back. An antibiotic may not stop an infection for several reasons. A microbe might change itself just enough so that the antibiotic doesn’t recognize it. Also, an antibiotic might fail because that type has been used too often. Microbes may have learned about it already—and how to **resist** it. And some antibiotics have been used in the wrong way. Scientists keep trying to produce new, better antibiotics to fight stronger microbes.

Do You Know?

In 1928, Dr. Alexander Fleming discovered that a common bread mold would kill bacteria. This discovery led to the world’s first antibiotic, penicillin, which is still the world’s most widely used antibiotic.

Don’t Spread Disease

When you’re sick, it’s important to stay home and rest. This helps your body fight an infection. Staying home also keeps you from infecting other people.

Remember that there are simple things we can do to stop germs from spreading. If you’re sick, don’t share food, cups, or plates with other people. If you have a cold, carry tissues. When you blow your nose, cover it. When you cough, cover your mouth. Use a tissue, then throw away the tissue in a trash can. Used tissues can infect other people. Remember to cover it and toss it! And remember to wash your hands.



Germs, or harmful microbes, spread easily in crowded places.

Staying Healthy

Keep your immune system healthy

- In order to stay healthy, you must keep your immune system strong. Eat a balanced diet of nutritious foods, including fruits and vegetables, and drink lots of water. Get fresh air, exercise, and enough sleep each night.

Preparing food

- Wash knives and cutting boards with water and soap after cutting raw meat, and never let raw meat touch cooked foods.
- Do not eat food from dented or swollen cans.
- Do not eat food that has fallen onto the floor.

Keeping clean

- The most important microbe-fighting action is staying clean with soap and water. Eighty percent of diseases are transmitted through touch because many people do not wash their hands. If everyone washed his or her hands, we could cut down the spread of disease.
- Wash your hands after you go to the bathroom, after touching animals, and before and after you make and eat food. Wash with soap for at least fifteen seconds, or as long as it takes to hum the song "Happy Birthday" twice. Rub soap lather all over your hands, even under your fingernails. Then rinse your hands and dry them on a clean towel.

Take care of your teeth

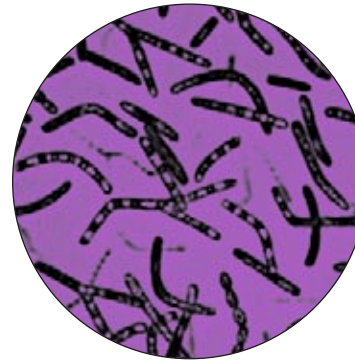
- Brush and floss your teeth to remove bits of food. Mouth bacteria cause cavities and feed on rotting food. Infections can easily get into your bloodstream through your mouth.

See a doctor regularly

- A healthy person should see a doctor once a year. Getting a regular checkup can prevent problems before they begin. Make sure you get all of your shots.

Outdoor safety

- When you go outside, do not touch wild animals. They may bite or scratch, or they may have disease-carrying bugs on them. Wear insect repellent to keep mosquitoes and ticks away when camping or hiking.
- Don't drink water that has not been purified and chlorinated.



Conclusion

Microbes live in, on, and around almost everything. Most microbes are harmless. But harmful ones cause disease. Scientists and doctors around the world are trying to control or eliminate diseases. We know that we can never wipe out all of the world's harmful microbes. But we can learn how to help control them and how to be healthier.

Glossary

antibiotics (<i>n.</i>)	medicines made from microbes to fight infections from other microbes (p. 19)
cells (<i>n.</i>)	the smallest independently functioning units in organisms (p. 7)
contaminated (<i>adj.</i>)	covered with harmful microbes (p. 14)
disease (<i>n.</i>)	a condition that changes the way the body normally functions (p. 4)
epidemic (<i>n.</i>)	the rapid spread of a disease within a community (p. 15)
immune system (<i>n.</i>)	system that moves antibodies through your body to fight infection (p. 7)
infection (<i>n.</i>)	illness caused by microbes (p. 7)
lactose (<i>n.</i>)	sugars found in milk (p. 10)
microscope (<i>n.</i>)	a device used to view tiny objects (p. 5)
mutate (<i>v.</i>)	to permanently change (p. 12)
organisms (<i>n.</i>)	living things, including people, other animals, plants, and microbes (p. 5)
outbreak (<i>n.</i>)	the quick spread of a disease (p. 15)

pandemic (<i>n.</i>)	the rapid, worldwide spread of a disease (p. 15)
resist (<i>v.</i>)	to fight against something (p. 19)
symptoms (<i>n.</i>)	telltale signs of an illness (p. 11)
vaccines (<i>n.</i>)	preparations containing a weak disease that teach the body to fight stronger forms of the same disease (p. 16)



Index

antibiotic(-s), 19	microbe(-s), 4, 5, 7–9, 13, 14, 16, 18, 19, 22
bacteria, 5, 9, 10, 14, 16, 19, 21	organisms, 5, 6, 9, 13
blood, 4, 7, 8, 14, 21	outbreak, 15
chicken pox, 12	pandemic, 15
cowpox, 17, 18	Pasteur, Louis, 6, 18
epidemic(-s), 15, 17	pasteurization, 6
Fleming, Alexander, 19	penicillin, 19
food poisoning, 9, 10	protozoa(-n), 5, 13
fungi, 13	salmonella, 9
germ theory of disease, 6	smallpox, 16–18
immune system, 7, 8, 16, 18	strep throat, 9
infection(-s), 7, 9, 11–15, 18–20	vaccine(-s), 16–18
Jenner, Edward, 17, 18	virus(-es), 5, 11–14, 16–18
malaria, 13	West Nile virus, 13

Name _____

INSTRUCTIONS: Write a vocabulary word from *Microbes Friend or Foe?* in each *Word Box*. Write a definition, a synonym, and an antonym for each word in the appropriate boxes. Then use each word in a sentence.

Synonym		Word Box		Antonym
↓				
Definition				
↓				
Sentence				

MICROBES: FRIEND OR FOE? • LEVEL U • 1

Synonym		Word Box		Antonym
↓				
Definition				
↓				
Sentence				

SKILL: CONTENT VOCABULARY

Name _____

INSTRUCTIONS: Identify and list the important information from the chapter in the *Important Information* boxes. Then use the information to create a summary in the *Summary* box.

Important Information	Important Information	Important Information	Important Information

MICROBES: FRIEND OR FOE? • LEVEL U • 2

Summary

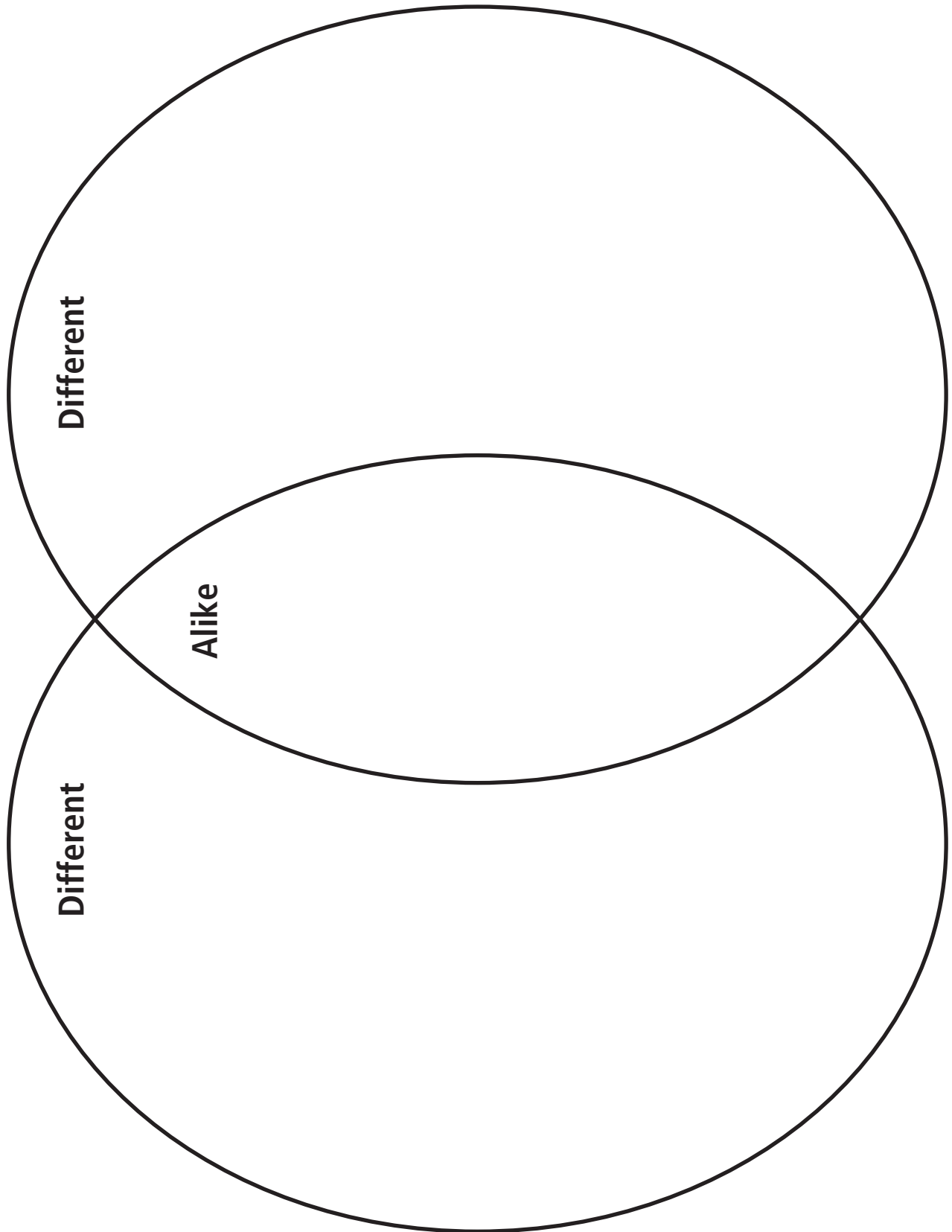
SKILL: SUMMARIZE

Name _____

INSTRUCTIONS: Use the information on pages 17 through 19 to compare and contrast vaccines and antibiotics. Write details that tell how vaccines and antibiotics are different in the outer circles. Write details that tell how they are alike where the circles overlap.

Topic: _____

Topic: _____



Name _____

INSTRUCTIONS: Read the sentences below. In each sentence, find the comparative or superlative adjective and circle it. On the line to the right, identify it by writing either *comparative* or *superlative*.

1. An antibiotic medicine kills most microbes,
but the strongest often survive. _____
2. Children's and senior citizens' immune systems
are weaker than those of healthy adults. _____
3. If a person stops taking antibiotics before finishing
the full dose, the toughest microbes will live. _____
4. Scientists keep trying to produce new antibiotics
to fight microbes that are stronger than others. _____
5. Smallpox was one of the deadliest diseases
in the world at the time. _____
6. Tiny protozoa are the simplest animals in the world. _____
7. Viruses are even smaller than bacteria. _____
8. Some organisms larger than protozoa
use the protozoa for food. _____
9. The microbes that survive will multiply
and become even stronger microbes. _____
10. When the microbes that survive multiply,
they will be deadlier than ever before. _____

Yellow Brick Roadies

A Reading A-Z Level U Leveled Reader

Word Count: 2,171



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Yellow Brick Roadies



Written by Lori Polydoros
Illustrated by David Cockcroft

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Yellow Brick Roadies

Note: *Yellow Brick Roadies* is the fourth in a continuing series written by Lori Polydoros, inspired by L. Frank Baum's *The Wonderful Wizard of Oz*. Travel with Miguel Ventura and his family as they experience classic adventures.



Written by Lori Polydoros
Illustrated by David Cockcroft

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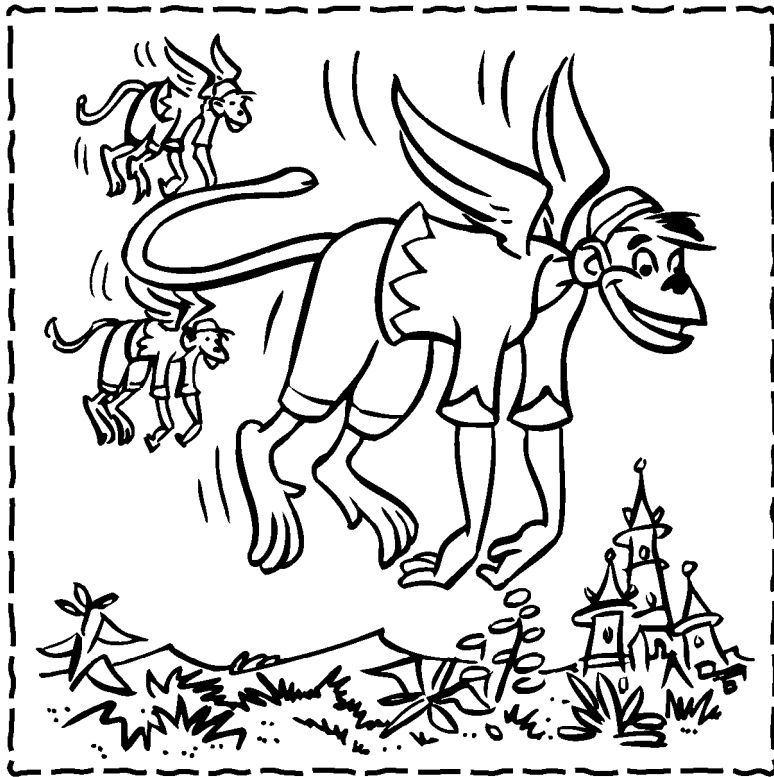


Table of Contents

A Cloud of Guilt	4
A Road Trip to Oz	8
A Bump in the Road	13
Stay on the Yellow Brick Road	16
Glossary	24

A Cloud of Guilt

One week of sixth grade down, one well-earned weekend coming up. Miguel headed down the street with his two friends, Trevon and Leo. Someone screamed from behind, "Watch out!"

Thud.

Crash.

A boy wearing inline skates smashed onto the asphalt; books and papers scattered everywhere.

Trevon and Leo laughed.

The boy's name was Dorian, and he was in Miguel's class.



Despite his bloody knees, Dorian tried to stand up, but **winc**ed in pain. Miguel rushed out to help him, but Trevon stepped between them. "Leave him here," Trevon said. "He told the teacher we were tackling in flag football yesterday."

"He needs help," Miguel said.

"We're out of here," Leo said.

Dorian and Miguel stared at each other. Miguel looked away and followed his friends.

"What's up with you?" Leo asked him.

Miguel had been a friend to Trevon and Leo since first grade, but this year, they were really getting under his skin. They had always attempted to be tough and cool, but they'd never been cruel.

"Nothing," Miguel said as he opened the door to his family's sandwich shop. "See you later."

Trevon raised his eyebrow. Leo shrugged his shoulders.

As Miguel walked in, a cloud spread over him. It was neither a cloud of flour from baking bread nor a cloud of smoke from a burnt roll. It was a cloud of guilt.

The next morning, Miguel moped about the shop.

"Mom wants us to cut some fresh flowers," said his sister Teresa, waving a pair of scissors at him.

"So what happened yesterday to that kid on the skates?" she continued.

Miguel **furrowed** his brow. "How did you know about that?"

"It happened in front of the shop window," Teresa said.

"Nothing happened." Miguel grabbed the scissors from Teresa and stalked out to the flower garden in the empty lot next door.

"Why didn't you help him?" Teresa asked, following at Miguel's heels.

"Don't worry about it." He cut a bunch of bright orange poppies.



"I know a bully or two when I see one." Teresa said.

"They're not bullies," Miguel said.

Teresa lifted her eyebrows.

"They were mad at Dorian for ratting us out in P.E. the other day."

"Yo, Miguel!" It was Trevon.

"Playing in the flowers?" Leo teased.

"Finish this," Miguel said, holding out the scissors without looking at Teresa.

What they did to Dorian was wrong, but if he said anything, would Trevon and Leo still want to be his friends?

"So what's up for today?" Leo asked "Not inline skating, I hope." Trevon snickered.

Miguel's stomach turned, but he tried not to think about what had happened yesterday. He needed to distract Trevon and Leo from **ranting** about Dorian and P.E. class again. The Great Gallardo—that was it! He'd take his friends into one of his Great Grandpa Gallardo's magic stories. From then on, they'd have no doubt that Miguel was cooler and tougher than them both.

A Road Trip to Oz

Miguel had already traveled into many stories from the chest full of books in the loft and had become characters such as Huckleberry Finn and Sherlock Holmes.

"Follow me," Miguel said as he led the boys into the shop's back room and up the rickety ladder to the loft.

"Hey, what's in here?" Leo opened Gallardo's chest of books. "Books? C'mon, Miguel!"

"These are no ordinary books," Miguel said, as the sparkling red letters of one title caught his eye . . . *The Wizard of Oz*.

The book fluttered open by itself to page 54. That grabbed their attention. Miguel began to read, "This was an eventful day for the travelers. They had hardly been walking an hour when they saw before them a great **gorge** . . ."

"Boring," Trevon insisted as he peered closer at the book.

"Just wait," said Miguel, as the words jiggled around the page . . . "*and big could were so rocks It very deep was there sides steep at many climb many jagged them down. Bottom also the that of none the . . .*"

Miguel's heart sped up. "Shut your eyes!" Everything in the loft spun as though they were on a crazy merry-go-round.

Then the spinning stopped.



Miguel walked in the woods, swinging his straw arms, side to side. He'd become the scarecrow!

A long, golden tail brushed against him. It was a **regal**-looking lion. "Mi . . . Miguel?" the lion said as he cocked his head.

"Leo!" Miguel cried.

Something creaked. Leo and Miguel peeked around a tree and saw the Tin Woodsman. "Oil please . . .," he squeaked.

Miguel shot a few squirts of oil into the metal man's joints. He kicked, swung, spun, and jumped. The Tin Woodsman was break dancing!

"Trevon?" both boys said.

He bowed. "At your service."

Miguel told them about the Great Gallardo's books. He described his adventures on the moon and as a pirate on Jackson's Island.

"I don't remember much about this book," said Leo as he looked about.

"Let's explore!" Trevon said.

"Wait, guys," Miguel said. "In every Gallardo book, there's a **mission**." The other boys took off anyway.



"Yip! Yip! Yip!" a dog barked.

Trevon and Leo charged back with a little black dog on their tails.

Toto! Miguel thought. A girl came up from behind them, and the dog jumped right into her arms.

"Don't forget," Miguel whispered, pointing the girl out to Leo and Trevon, "our characters must help Dorothy get to the wizard of Oz."

Leo and Trevon looked at each other. "We're not helping some girl. We're in Oz!" They ran into the woods.

"Stay on the yellow brick road!" Miguel shouted, wondering what he had done by bringing them here.





A Bump in the Road

"Emerald City is that way," said Dorothy as she pointed across a gorge full of jagged rocks. "How do we get to the other side?"

Miguel had read *The Wizard of Oz* to Teresa. He remembered aloud, "Lion can jump it!"

"Yes, we can ride on his back," Dorothy said.

"I'll find him," Miguel said.

He tramped through the trees until he came upon Lion **looming** in a cave opening. "Leo! What are you doing?" Miguel asked.

In the darkness of the cave, a raccoon and rabbit trembled. Miguel frowned.



"I'm King of the Forest!" Leo roared. "No one can touch me."

"We need you to give us a ride across the gorge," Miguel said.

"Nobody's riding on my back."

"Dorothy needs you," Miguel said.

"I'm not going to spend my time here in Oz taking care of Dorothy," Leo stated.

Miguel muttered something about courage under his breath.

Leo faced Miguel. "What did you say?"

"Nothing." Miguel looked around for Trevon. Miguel remembered his ax could cut down a tree to make a bridge.

Trevon stood within a mess of hacked away trees.

"I'm Paul Bunyan!" he yelled. "I'm strong enough to cut anything. Watch!"

Trevon drew his ax over his shoulder, bringing it down—*thwack*—across an evergreen tree at least five feet thick. The tree swayed, casting a dark, moving shadow across the ground before it slammed against the dirt, causing vibrations like an earthquake.

"Why did you do that?" Miguel asked. "You've destroyed this whole part of the forest!"

"I'm superhuman!" Trevon whacked his ax against a small boulder, causing a spark.

"Stop." Miguel grabbed the ax handle. "Dorothy needs to cross a gorge to get to Emerald City."

"Who cares?" Trevon said. "I'm not going to waste my superpowers on Dorothy."

Miguel mumbled something about not having a heart, like the real Tin Woodsman.

"You got something to say?" Trevon barked.

Miguel felt hot. He shook his head with regret, and then his heart dropped. If Dorothy didn't get to the wizard, would he ever get home?

Stay on the Yellow Brick Road

Dorothy and Toto were busy building some kind of **contraption** when Miguel got back to the gorge.

"What are you making?" he asked.

"A slingshot." Dorothy pulled on a big, stretchy band tied between two pine trees. A piece of leather functioned as a seat in the middle of the band.

"Where'd you get the supplies?" Miguel asked, feeling the stretchy band.

"I'm **resourceful**," she answered mysteriously.

"You're going to fling yourself across?"

"I have no choice," Dorothy said. "I have no lion to ride on and no woodsman to chop down a tree."

"I'm sorry about that."

"It's not your fault." She placed her food basket in the seat. "I just hope you speak up for what's right. Watch this!"

She pulled back hard on the band and let go. *Wham!* The basket flew across the gap and landed safely in a field of bright orange poppies.

"You did it!" Miguel said, quite impressed.



Dorothy laughed. "Would you be so kind?" She climbed into the seat, hugging Toto tightly.

Miguel stretched the band, closed his eyes, said a little prayer, and let go.

"Wheee!" Dorothy's voice trailed off.

He opened his eyes and there she stood, waving at him from the other side. "We'll meet you on the yellow brick road," he shouted after her.

Miguel hurried back into the forest. He found Trevon and Leo crashed out by the side of a lake.

"I can't believe you're tired of bullying little creatures, Leo," Miguel shouted. "And you, Trevon, why don't you go destroy more forest?"

"What is your problem, Miguel?" Leo growled. "You've been a pain ever since we started sixth grade. It's like you're judging us all the time."

Miguel's blood boiled. He took a deep breath and started to count to ten. *One . . . two . . . three . . . four.* Before he made it to five, a strange sound filled the air. Hundreds of flying monkeys hovered like helicopters above them.

"Run!" Miguel yelled as monkeys dove at them. "Oh no!" Two flying monkeys lifted Trevon. Miguel hurried toward Leo. "We've got to save Trevon!"

The lion **cowered** behind a tree stump.

"I'll distract the other monkeys, you swat Trevon out of the claws of those two," Miguel said.

"No way," Leo roared.

"This is Trevon's life." Miguel grabbed the lion's mane and stared hard into Leo's eyes. "After you get Trevon, jump across the gorge with him on your back. I'll meet you on the other side."

Leo nodded.



Miguel ran ahead, zigzagging in and out of the trees, causing the monkeys to scatter.

Leo charged, leapt high into the air, and grabbed Trevon. The Tin Woodsman clung to Lion's back as they dashed for the gorge. Leo stopped hard at the edge, crouched low, and sprang high into the air.

Miguel's only hope was the slingshot.

With arms and legs flailing, Miguel launched himself across the gorge. Dorothy, Trevon, and Toto sat upon Leo's back awaiting Miguel. Leo tossed Miguel the Scarecrow onto his back and ran hard until the monkeys were out of sight. But as in the original story, the **toxic** scent from the poppies soon overwhelmed Leo and Dorothy.

"Trevon, you have to chop off the wildcat's head to save the Queen of the Mice," Miguel said. "Later, the mice will help carry the lion out of the poppy field."

"What? Chop off whose head?" Trevon asked.

"It's the only way to save Dorothy and Leo," Miguel said. "We have to get back to the yellow brick road."

A loud howl rushed at them. Foaming at the mouth, a huge wildcat chased a tiny mouse through the poppies. The Tin Woodsman clanged his eyelids shut and drew back his ax. Miguel closed his eyes too.



A cloud of thought and emotion swirled about his head before he awoke in the loft with his two friends. They had done it! Dorothy and her gang were back on track to Emerald City.

"Was all that real?" Leo asked.

Miguel nodded.

"That was like a bad nightmare," Trevon said.

Miguel had a huge lump in his throat. "You two were the nightmares."

Trevon and Leo stared at Miguel.

"All you care about is yourselves," Miguel said. "We almost didn't make it back because of you two."

"It was wrong how you wouldn't help Dorothy," Miguel said. "And it was cruel what we did to Dorian the other day."

Trevon's eyes grew large. Leo fidgeted with the buttons on his shirt.

"You can count me out of this friendship," Miguel said. "See you guys around."

"Miguel, wait up." Leo ran next to him, and Trevon blocked his path.

"We've been jerks," Leo said.

"I don't know why we've been acting like this," Trevon said. "We're sorry."

Miguel's heart felt lighter as they walked out of the shop and into the garden.

"Thanks," said Trevon, "for helping us find the right road."

"The yellow brick road?" Miguel asked.

"Yeah, that's the one." The boys high-fived before Trevon and Leo walked home.

Miguel saw Teresa in the garden. She had a slingshot in her pocket.

"Wait a minute, you haven't been reading *The Wizard of Oz*, have you?"

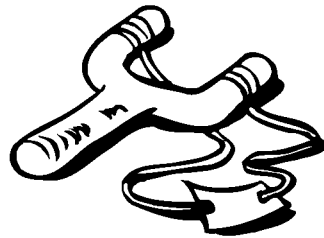
Teresa giggled. "No, not really."

"Not *really*?"

"Well, I might have given Dorothy a little advice . . ."

"Advice?"

"How to stay on the yellow brick road, of course!" Teresa smiled, and so did Miguel. He put his arm around her, and they walked into the shop.



Glossary

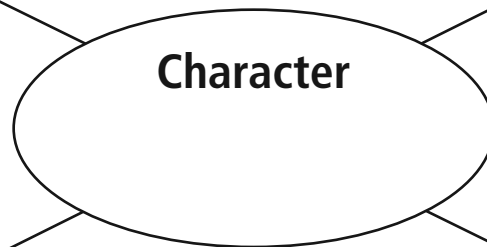
contraption	a strange device made to do something (p. 16)
cowered	to have hidden from danger (p. 18)
furrowed	made to look like a deep wrinkle in the skin (p. 6)
gorge	a long and deep valley surrounded by higher land (p. 8)
looming	standing over someone else menacingly (p. 13)
mission	a set purpose for doing something (p. 10)
Oz	a mythical place (p. 12)
ranting	loud, continuous talking (p. 7)
regal	appearing like a king (p. 10)
resourceful	good at using available materials to solve problems (p. 16)
toxic	poisonous; dangerous to life (p. 20)
wincing	having involuntarily moved part of one's body because of a sharp pain (p. 5)

Name _____

Instructions: Write *Miguel* in the circle labeled *Character*. In each box, list a *character* trait that describes Miguel, along with story clues that helped you identify the trait. Then on the back of the worksheet, list two character traits and supporting clues that describe Leo and Trevon.

Trait:
Clues:

Trait:
Clues:

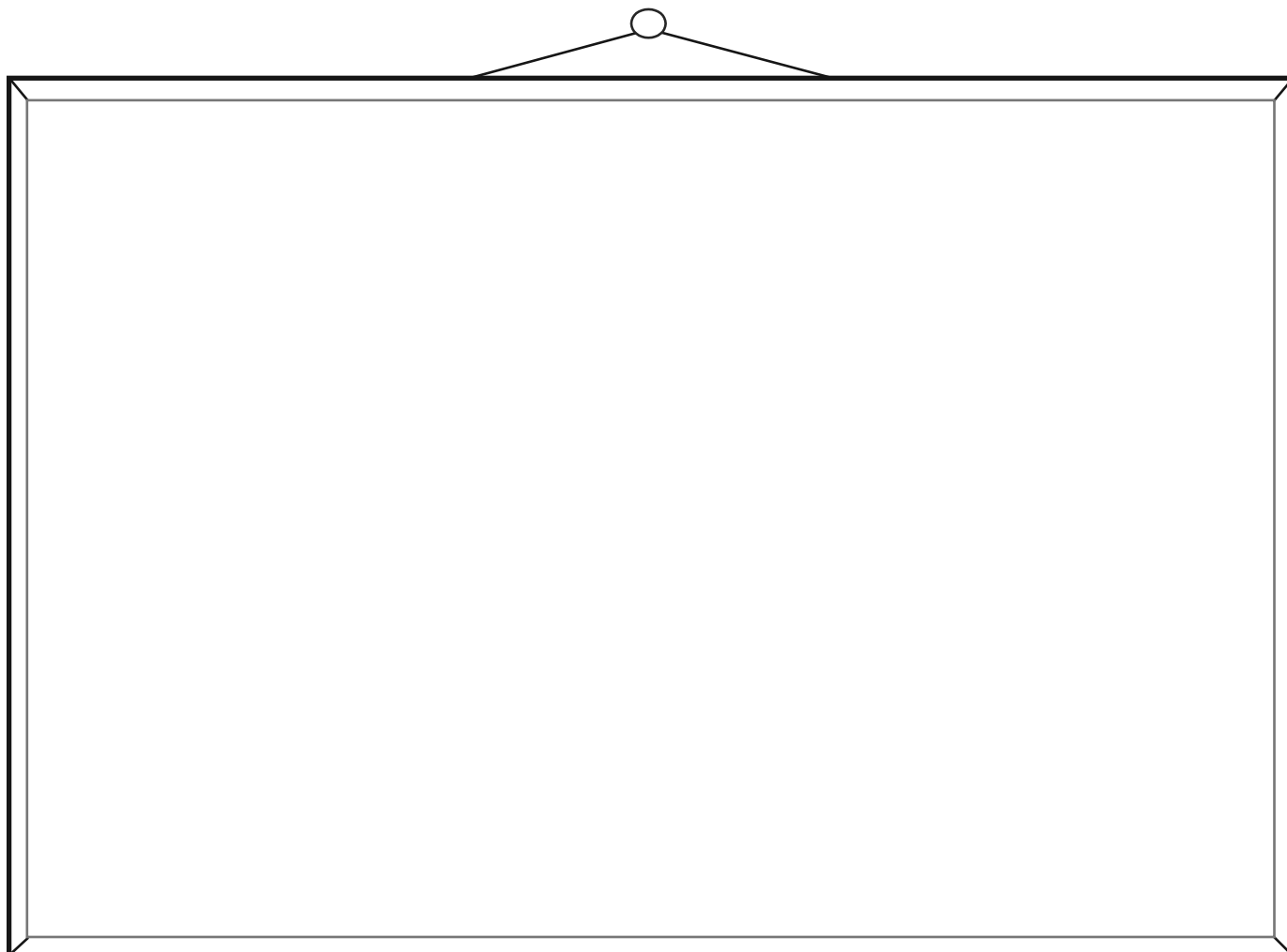


Trait:
Clues:

Trait:
Clues:

Name _____

Instructions: Draw a picture to represent a part in the story where you stopped to visualize in order to understand what you have just read.



Instructions: Write a description to explain your drawing.

A large rounded rectangular box with a spiral binding on the left side, intended for writing a description.

Name _____

Instructions: Write C on the line if the sentence is a compound sentence and NC if the sentence is not a compound sentence. Circle the conjunction that separates the two parts of each compound sentence.

_____ 1. Everything in the loft spun as though they were on a crazy merry-go-round.

_____ 2. Miguel had been a friend to Trevon and Leo since first grade,
but this year they were really getting under his skin.

_____ 3. As Miguel walked in, a cloud spread over him.

_____ 4. What they did to Dorian was wrong, but Miguel didn't know
if he should say anything to them.

_____ 5. Leo and Miguel peeked around a tree and saw the Tin Woodsman.

_____ 6. A girl came up from behind them, and the dog jumped right into her arms.

_____ 7. The Tin Woodsman clanged his eyelids shut and drew back his ax.

_____ 8. He put his arm around her, and they walked into the shop.



Name _____

Instructions: Read the idioms listed below from *Yellow Brick Roadies*. Explain what each phrase means on the lines below the idiom.

1. ratting us out

2. caught his eye

3. on their tails

4. his heart dropped

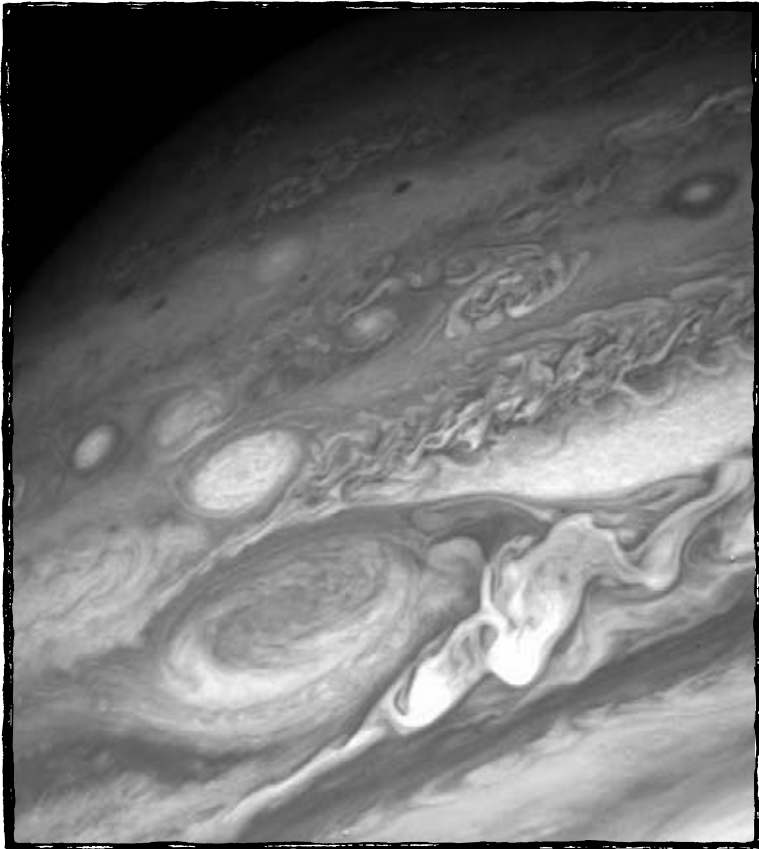
5. Miguel's blood boiled

Instructions: In your own words, explain what idioms are and why people use them in everyday language.

Jupiter's Secrets Revealed

A Reading A-Z Level U Leveled Reader

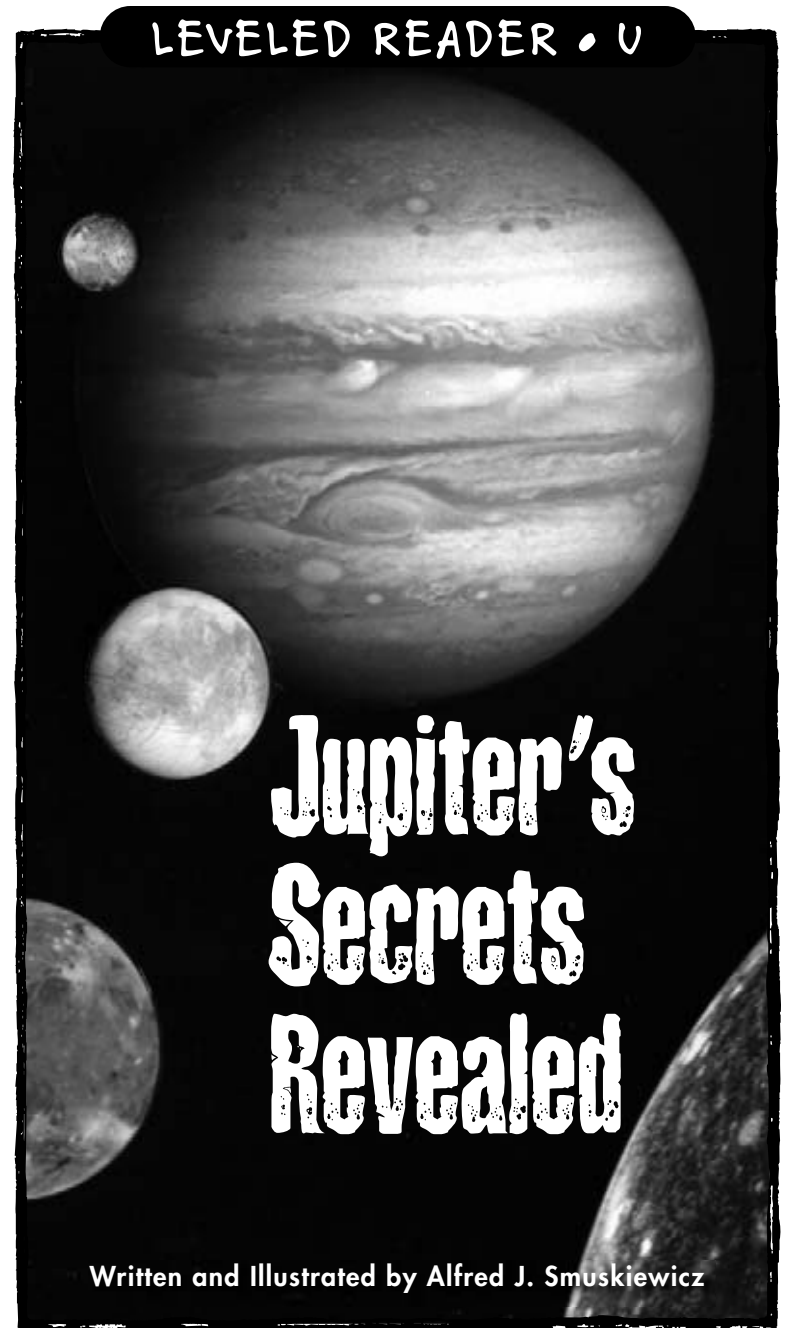
Word Count: 1,578




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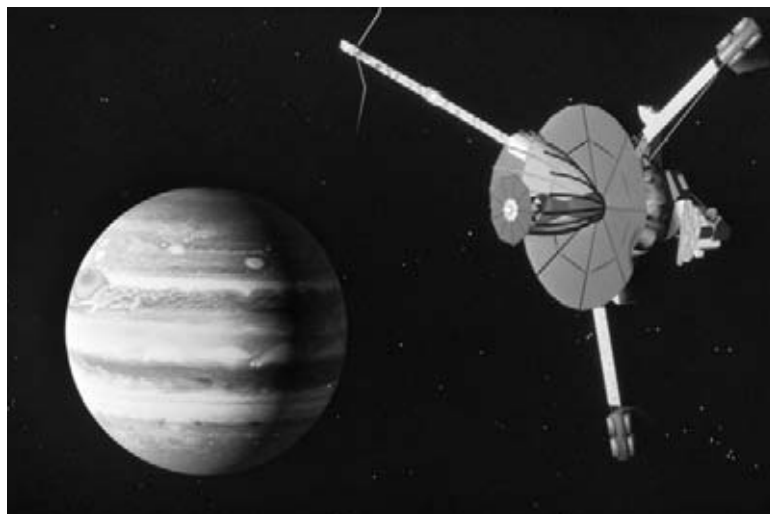
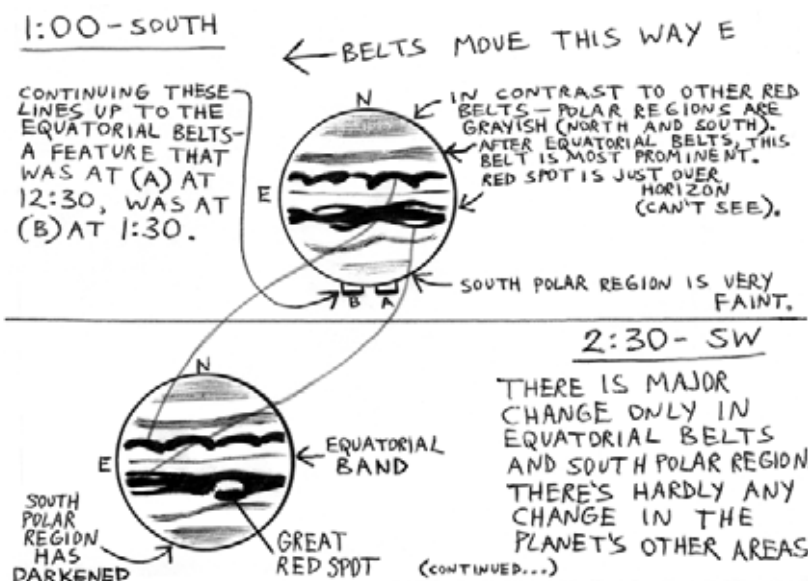


Table of Contents

The Night Jupiter Surprised Me	4
What and Where Is Jupiter?	6
What Is Jupiter Made Of?	10
Weather Report from Jupiter	12
The Moons of Jupiter	14
The Rings of Jupiter	17
Spacecraft Visits to Jupiter	18
How You Can Watch Jupiter	20
What's Next for Jupiter?	22
Glossary	23
Index	24

August 7, 1985 Sketch



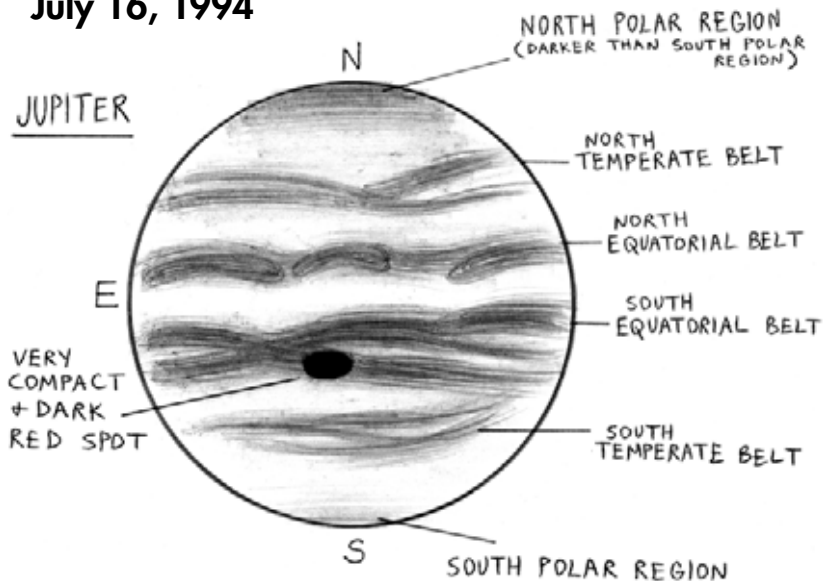
The Night Jupiter Surprised Me

I enjoy looking at the night sky with my telescope. But I've found that most things you see through a telescope appear the same every time you look at them. That's why I was surprised one night in August 1985 while I was looking at Jupiter. I was drawing a sketch of the planet with a pencil when I noticed that the swirly, colorful stripes on Jupiter were moving and changing right before my eyes! I still remember how excited I was by this discovery—even though it made my sketch harder to finish!

I saw Jupiter change again, right before my eyes, in July 1994. It was the last night that big chunks of a broken-up **comet**—called Comet Shoemaker-Levy 9—collided with the planet. I saw several dark “bruises” on Jupiter where the chunks of the comet hit. I drew pictures of these too as I thought about how cool it was to see them through a telescope.

Jupiter is the biggest planet in our **solar system** and one of the brightest objects in the night sky. Seen without a telescope, it looks like a star. I have found Jupiter to be full of surprises, and I think it is the most exciting planet.

July 16, 1994



What and Where Is Jupiter?

At about 484 million miles (779 million km) from the Sun, Jupiter is five times farther from the Sun than Earth. Jupiter is the fifth planet from the Sun. (Earth is the third planet from the Sun.)

Jupiter is so far away that it takes 12 Earth-years for it to **orbit** the Sun one time.

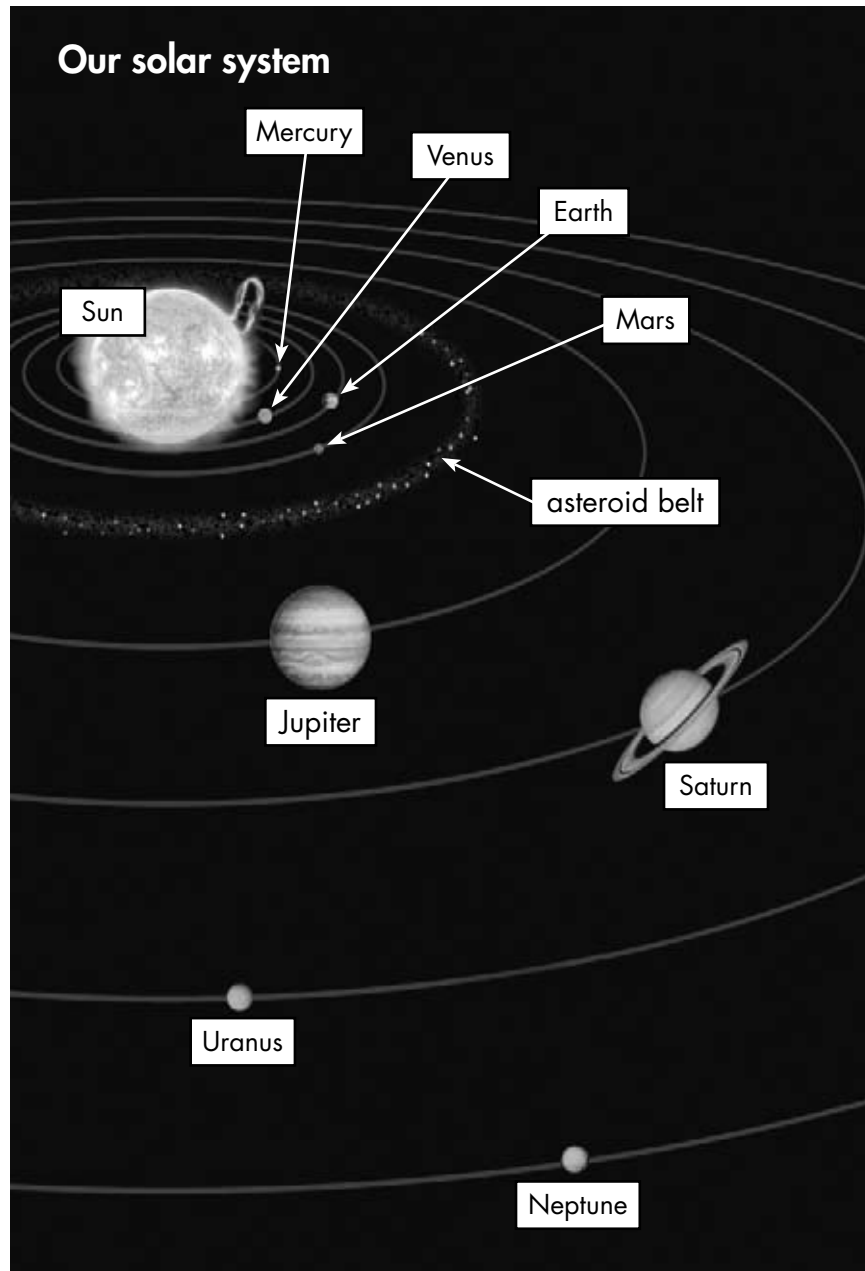
Jupiter, the giant of our solar system, has a **diameter** of about 89,000 miles (143,000 km) across its middle, or **equator**.

Jupiter is so large that if Earth were a small grape, Jupiter would be a large grapefruit!



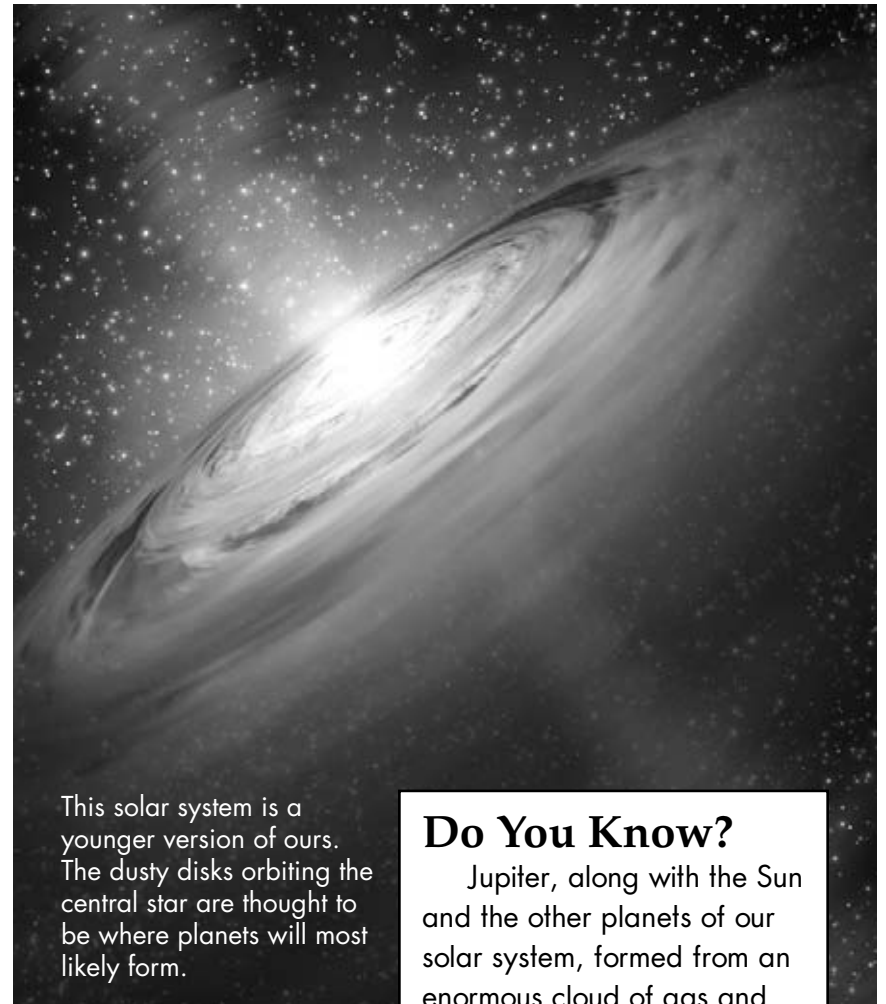
What's In a Name?

Jupiter was named by people who lived in ancient Rome more than 2,000 years ago. To the Romans, Jupiter, who was also known as Jove, was the king of the gods. His weapon was a thunderbolt. The god Saturn, another planet's name, was the first ruler of the universe, according to the Romans, but his children—including Jupiter, Neptune, and Pluto—overthrew him. Jupiter married the goddess Juno, and their children included Mars and Vulcan.



Jupiter orbits the Sun as the fifth planet, in between Mars and Saturn. Where is Earth in relation to Jupiter?

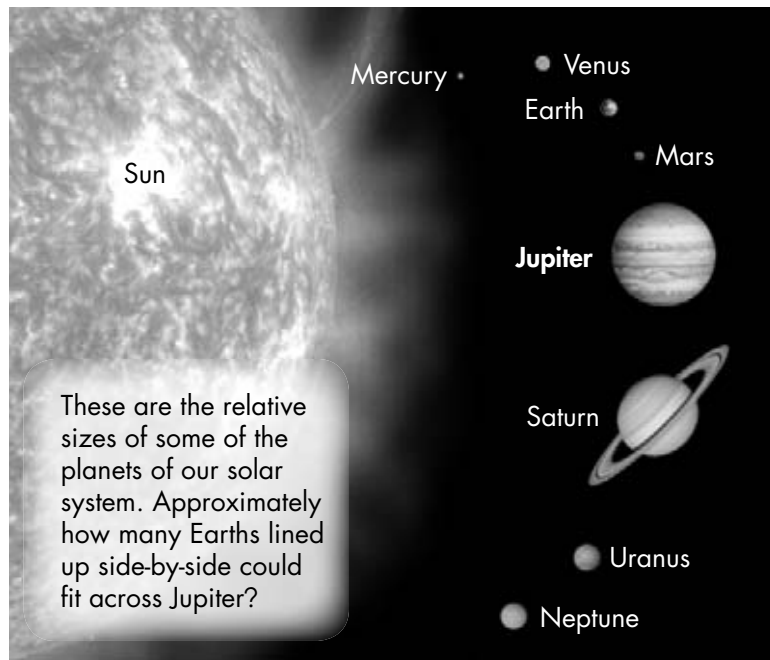
Every 9 hours and 55 minutes, Jupiter rotates once on its **axis**. This is faster than any other planet, so one day on Jupiter is only 9 hours and 55 minutes long. Do you know how long it takes Earth to rotate once on its axis? Hint: How long is one day?



This solar system is a younger version of ours. The dusty disks orbiting the central star are thought to be where planets will most likely form.

Do You Know?

Jupiter, along with the Sun and the other planets of our solar system, formed from an enormous cloud of gas and dust 4.6 billion years ago.



Planet	Diameter (Width) Across Equator (Middle)	Average Distance From Sun
Mercury	3,032 mi (4,879 km)	35,980,000 mi (57,910,000 km)
Venus	7,521 mi (12,104 km)	67,240,000 mi (108,210,000 km)
Earth	7,926 mi (12,756 km)	92,960,000 mi (149,600,000 km)
Mars	4,222 mi (6,794 km)	141,620,000 mi (227,920,000 km)
Jupiter	88,846 mi (142,984 km)	483,780,000 mi (778,570,000 km)
Saturn	74,898 mi (120,536 km)	890,750,000 mi (1,433,530,000 km)
Uranus	31,763 mi (51,118 km)	1,784,860,000 mi (2,872,460,000 km)
Neptune	30,775 mi (49,528 km)	2,793,100,000 mi (4,495,060,000 km)

What Is Jupiter Made Of?

Not all planets are like Earth, which has a solid surface for you to walk on. Jupiter is mostly a big ball of gases and liquids. Like the Sun, it is made mostly of the chemical elements **hydrogen** and **helium**, which are the two lightest elements, but also has water, ammonia, and methane.

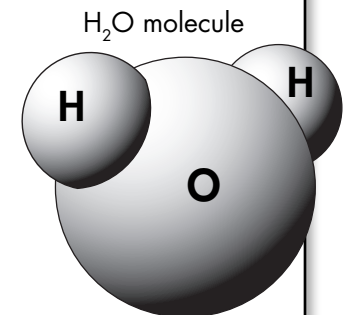
The many swirly, reddish, whitish, and yellowish stripes that I saw on Jupiter through my telescope are made of clouds of gas. The bright, wide stripes are gas clouds called zones. The dark, thin stripes are gas clouds called belts. The belts and zones move around the planet, but their winds flow in opposite directions—west to east in zones, east to west in belts.

Elements

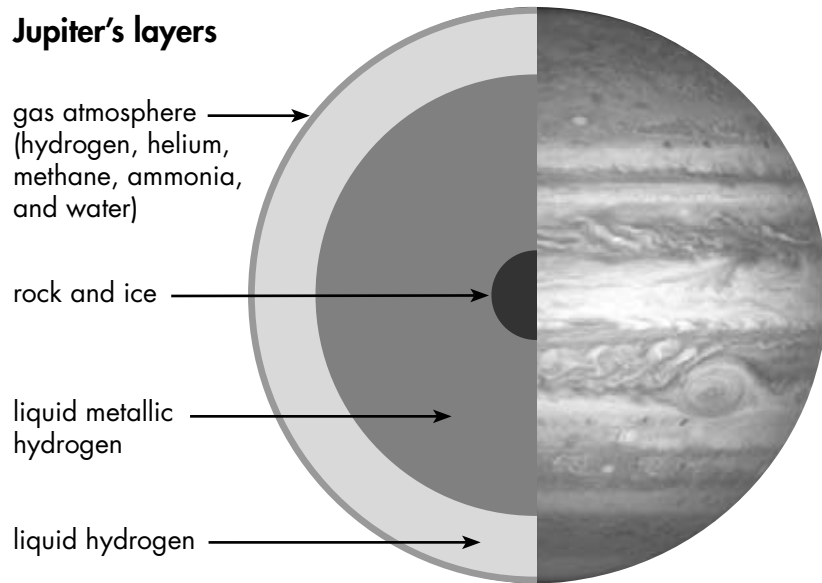
Elements are the simplest materials known. There are 92 known natural elements. All other materials are made from different combinations of these elements.

Molecules

Molecules are the smallest particles of a material or substance. They are made of two or more smaller particles called atoms. For example, the substance water (H_2O) is made of water molecules that consist of two atoms of the element hydrogen and one atom of the element oxygen.



Jupiter's layers



Scientists think that Jupiter is made of several layers, including a gas layer, a liquid hydrogen layer, a liquid metal layer, and a central ball of rock and ice.

Beneath the thin, cloudy **atmosphere**, the gases turn into liquids. The liquids form when the weight and pressure of the clouds above squeeze the gas molecules very close together. Molecules in liquids are closer together than molecules in gases. There is even a deep layer of liquid hydrogen that acts like liquid metal. This metallic hydrogen flows around the inside of the planet.

In the deepest parts of Jupiter, at the planet's very center, there may be a core of rock and ice that is bigger than Earth. However, scientists are still not sure what Jupiter's core is like.

Weather Report from Jupiter

Have you heard the weather report from Jupiter today? I heard reports of average temperatures of about -236 degrees Fahrenheit (-149 degrees Celsius). Now, that's cold! However, it could be as hot as $1,500^{\circ}\text{F}$ (800°C) at the highest cloud tops, where the Sun's rays are strongest.

Today, the winds are blowing out of the north at about 400 miles (650 km) per hour. Don't get caught out in one of the hundreds of swirling storms, similar to gigantic hurricanes, all over the planet. The largest storm, called the Great Red Spot, is so big that three Earths could fit across it! This storm, which can be seen through a telescope on Earth, has been raging for more than 300 years.

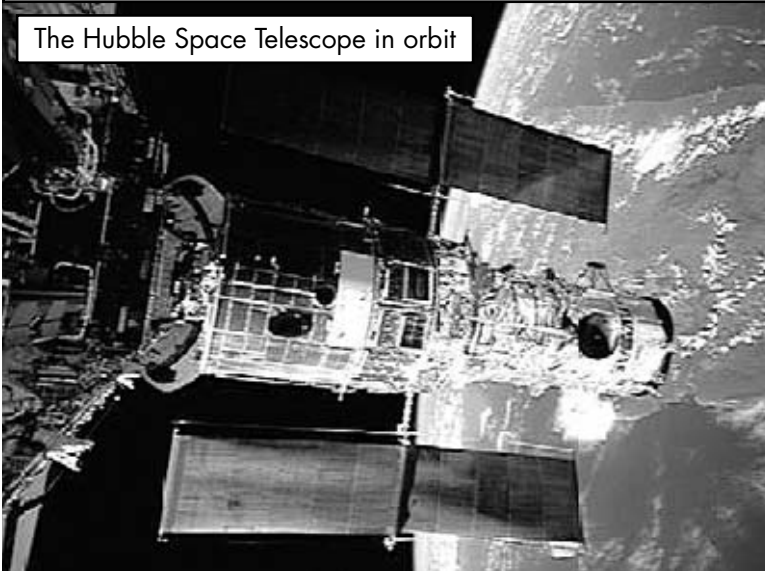


The weather on Jupiter includes giant storms, such as the Great Red Spot, huge flashes of lightning, and winds blowing hundreds of miles per hour.

Seeing Jupiter from Space

The Hubble Space Telescope has been used to take many sharp photographs of Jupiter and the other planets, as well as galaxies and other objects in deep space. This telescope is able to take very detailed pictures because it orbits Earth high above the atmosphere. (The high orbit allows the telescope to avoid the blurring that the atmosphere can cause in photos taken from the ground.) Astronauts on the space shuttle *Discovery* placed the Hubble Space Telescope in orbit in 1990. After several additional space shuttle missions to give the telescope new equipment, it was still working in 2006.

The Hubble Space Telescope in orbit



Finally, huge flashes of lightning have been reported lighting up the planet's storm clouds.

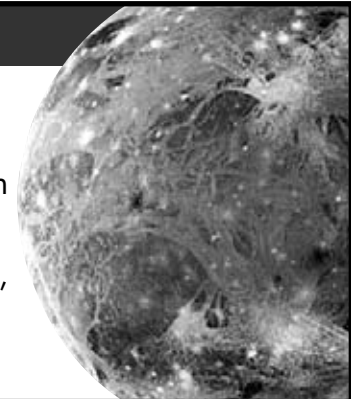
Does this sound like a good day for a picnic to you?

The Moons of Jupiter

At least 63 moons of various sizes orbit Jupiter. Sixteen of these moons are at least 6 miles (10 km) wide. The four largest moons—Io, Europa, Ganymede, and Callisto—were discovered by the Italian **astronomer** Galileo (GAL-uh-LAY-oh) Galilei, in 1610. These moons, known as the “Galilean satellites,” can easily be seen with a pair of binoculars.

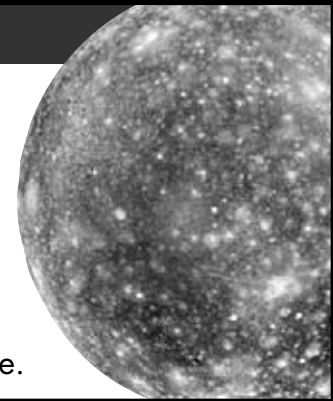
Ganymede

Ganymede (GAN-uh-meed) is Jupiter's largest moon—and the largest moon in the entire solar system. Its surface has many mountains, valleys, and **craters**, as well as ice mixed with rock.



Callisto

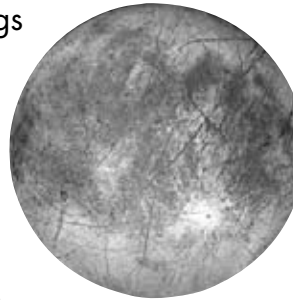
Callisto (kuh-LIHS-toh) is covered with many craters, which were made when comets and **asteroids** crashed into the moon. Like Europa, Callisto may have an ocean of salty water under its surface.



Europa

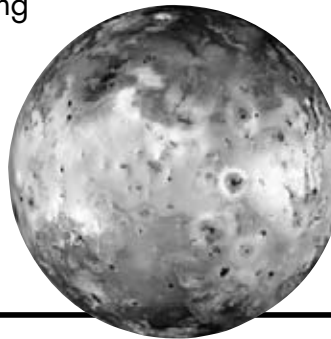
Europa (yu-ROH-puh) has a surface covered with ice. Deep cracks run through the ice, dividing it into large chunks that are like icebergs on Earth, only Europa's icebergs are the size of Earth's cities!

Underneath the cold, cracked ice, there may be a deep, dark ocean of warm water. Scientists think that, if this ocean really exists, alien creatures may live in it.



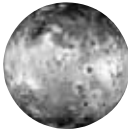
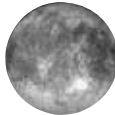
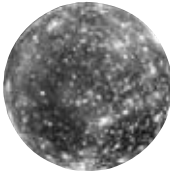
Io

Io (EYE-oh) has more than 300 volcanoes on its surface. These volcanoes shoot out hot plumes of sulfur dioxide gas and bubbling flows of melted rock (lava). Different kinds of chemicals in the lava flows make different colors all over Io's surface, including yellow, red, orange, and green.



Do You Know?

The volcanoes on Io shoot out so much rock and other material from deep inside the moon that Io has actually "turned inside out" many times. And a volcano on Io named Loki gives off more heat than all of Earth's volcanoes combined.

	Moon	Diameter	Avg. Distance From Jupiter
	Io	2,264 mi (3,643 km)	262,000 mi (421,600 km)
	Europa	1,940 mi (3,122 km)	416,900 mi (670,900 km)
	Ganymede	3,270 mi (5,262 km)	664,900 mi (1,070,000 km)
	Callisto	2,996 mi (4,821 km)	1,170,000 mi (1,883,000 km)

Revolutionary Discovery

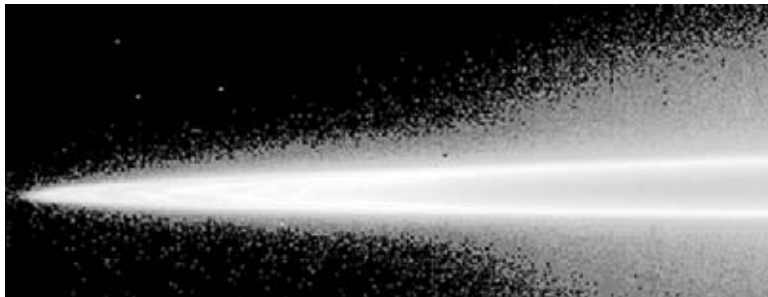
Galileo (1564–1642) made the first important discoveries with a tool that was new during his time—the telescope. Before Galileo used a telescope to discover the four largest moons of Jupiter in 1610, many people believed that the planets and the Sun revolved around Earth. Galileo's discovery that there are moons revolving around Jupiter was the first evidence that not everything moves around Earth. This discovery helped persuade other scientists that Earth and the other planets move around the Sun.

The Rings of Jupiter

People used to think that Saturn was the only planet with rings around it because its rings are the only ones that can be seen through a telescope on Earth. So scientists were surprised in 1979 when cameras on the Voyager spacecraft, which was flying near Jupiter at the time, took pictures of rings around the planet.

The pictures from Voyager showed that Jupiter has four rings that are much thinner than the rings of Saturn. Unlike Saturn's rings, which are made partly of large chunks of ice, Jupiter's rings consist of tiny particles of dust.

Scientists think that Jupiter's rings formed when **meteoroids** crashed into the planet's moons. These crashes threw dust into space, and this dust collected into rings.



Jupiter's main ring can be seen only by spacecraft that fly near the giant planet. The fuzz around the ring is created by the tiny particles that make up the ring.

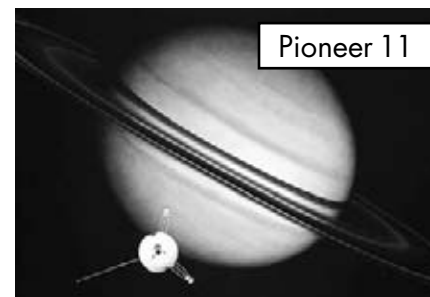
Spacecraft Visits to Jupiter



The U.S. National Aeronautics and Space Administration (NASA) has launched many spacecraft to Jupiter. These robot explorers have sent pictures and other information back to Earth with **radio waves**—the same kind of energy waves that carry signals to radios and televisions.

Pioneer 10 and Pioneer 11

Pioneer 10 and Pioneer 11 were two spacecraft that took the first close-up photographs of Jupiter in 1973 and 1974. These photos showed that the clouds of Jupiter were much more colorful and complex than people had believed.

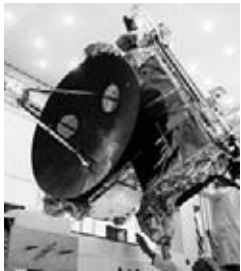


Much of what we know about Jupiter was discovered by the Pioneer, Voyager, Ulysses, and Galileo spacecraft, which were launched by NASA.

Voyager 1 and Voyager 2

In 1979, the Voyager 1 and Voyager 2 spacecraft discovered Jupiter's rings, as well as lightning and auroras on Jupiter. Auroras are colorful displays of light, similar to aurora borealis (northern lights) or aurora australis (southern lights) on Earth, that are created when energy particles from the Sun hit gas particles in Jupiter's atmosphere. The Voyagers also discovered that Jupiter's moons have many big features, such as volcanoes, ice, and craters.

Ulysses



The Ulysses spacecraft passed close to Jupiter in 1992 and again from 2003 to 2004. It measured the strength of the **magnetic field** around Jupiter and studied the charged particles trapped by the field.

Galileo

Galileo was the first spacecraft to orbit Jupiter. It circled Jupiter between 1995 and 2003, studying



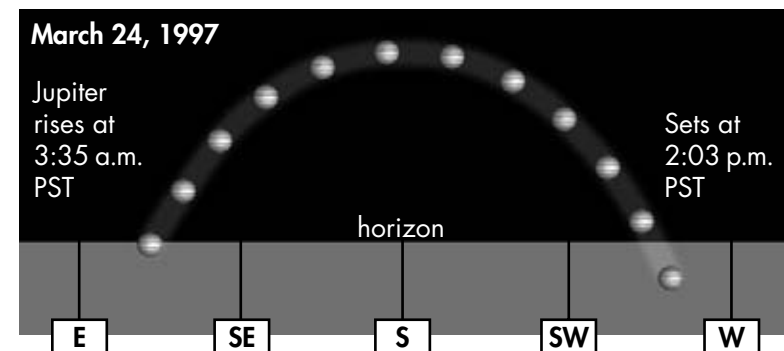
the mysterious planet and its moons. Galileo also released a small probe that parachuted into Jupiter's atmosphere. This probe had instruments that measured wind speed and the amounts of different chemicals in the atmosphere.

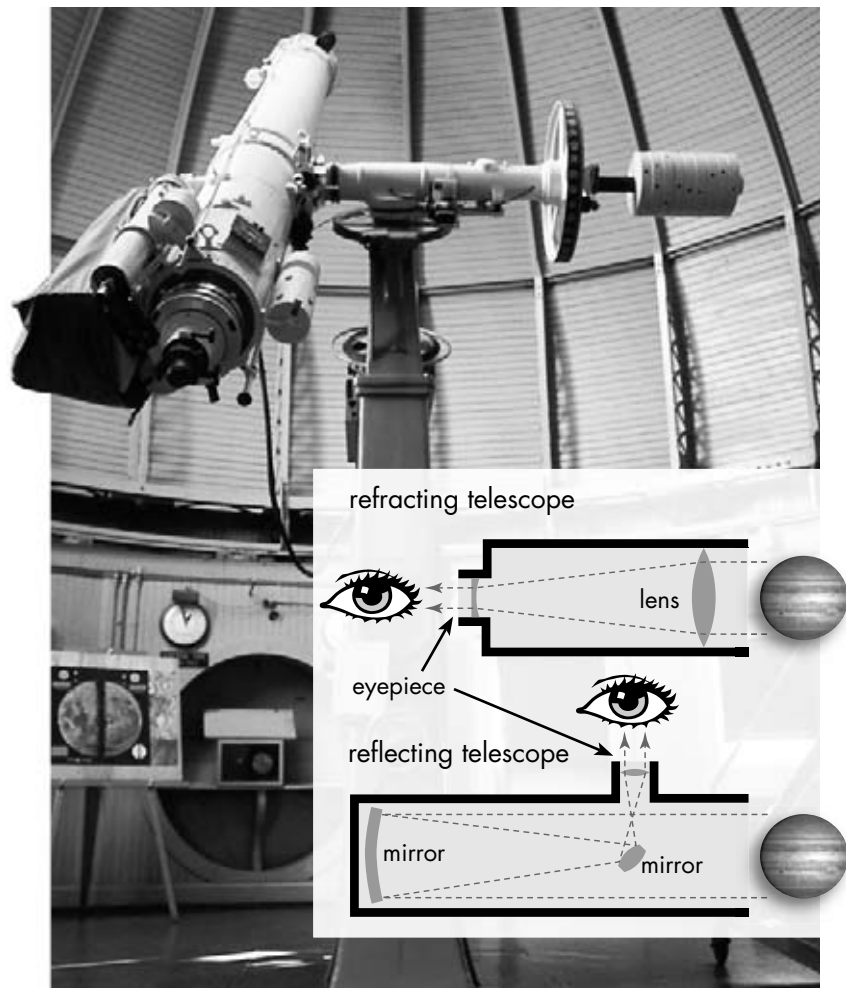
How You Can Watch Jupiter

Jupiter looks like a bright star that you can see in the southern part of the sky only at certain times of the year. To know exactly where and when to look for Jupiter, check the weather or **astronomy** section in your local newspaper. You can also check an astronomy magazine or website.

If you look at Jupiter with binoculars, you will be able to see the planet's four largest moons and watch them change their position around Jupiter from one night to the next.

With a telescope of medium power, you can see the belts and zones on Jupiter as well as the Great Red Spot, which also all change from night to night. It's fun to sketch what you see, but if you have a certain kind of telescope, you can use a camera to take photos instead.





Do You Know?

Two main kinds of telescopes are the refracting telescope and the reflecting telescope. A refracting telescope uses a large lens to focus light rays from an object to a point inside the telescope. A reflecting telescope focuses light rays with mirrors. With either kind of telescope, you look at the focused point of light rays through an eyepiece to see a magnified image of the object.

What's Next for Jupiter?

Jupiter is an exciting planet because it's a big ball of surprises. Scientists are always learning new things about this enormous planet, and you never know what they might discover next.

Scientists are working on many new plans to learn more about Jupiter and its moons. According to one of these plans, the United States and Europe would send a spacecraft to land on Jupiter's moon Europa. This craft would then melt through the moon's icy surface to study the ocean that scientists think might exist inside Europa, leading to the possible discovery of ocean life on this moon.



There's a lot to look forward to with Jupiter. Perhaps someday you will be able to discover an amazing new fact about this surprising giant in the sky!

Do You Know?

Jupiter's spin is slowing down because it is being pulled by the gravity of its moons. The same thing is happening to Earth because of its moon!

Glossary

asteroids	small rocky objects that revolve around the Sun (p. 14)
astronomer	a scientist who studies planets, stars, galaxies, and other objects in the universe (p. 14)
astronomy	the study of objects in space (p. 20)
atmosphere	a layer of gases surrounding a planet, star, or moon (p. 11)
axis	an imaginary line around which an object, such as a planet, spins (p. 8)
craters	holes in the ground caused by the impact of objects from space (p. 14)
comet	an astronomical object made of ice and dust that develops a long, bright tail as it nears the Sun (p. 5)
diameter	the length of a straight line drawn through the center of a circle or a sphere from one side to another (p. 6)
equator	an imaginary circle around the middle of a planet (p. 6)
helium	often a gas; the second lightest chemical element (p. 10)
hydrogen	often a gas; the lightest chemical element (p. 10)

magnetic field	the region around a magnet or planet where magnetic force can be felt (p. 19)
meteoroids	particles of metallic or stony matter that travel through space (p. 17)
orbit	the path that one celestial body, such as a planet or moon, follows around a larger celestial body, such as the Sun (p. 6)
radio waves	patterns of electric and magnetic force that carry information in radio and television broadcasts (p. 18)
solar system	the Sun and the celestial bodies that revolve around it (p. 5)

Index

Comet Shoemaker-Levy, 5	size, 6
Galilei, Galileo, 14, 16	spacecraft,
Great Red Spot, 12, 20	Discovery, 19
Jove, 6	Galileo, 19
Jupiter,	Pioneer, 18
atmosphere, 12	Ulysses, 19
distance from Sun, 9	Voyager, 19
interior, 11	telescopes,
moons, 14–16	Hubble, 13
rings, 17	reflecting, 21
	refracting, 21

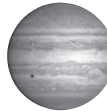
Name _____

Instructions: In the top box, write what you already know about Earth. In the first box, write what you know about Jupiter. In the second box, write what you would like to learn about Jupiter. After you finish reading, fill in the third box with information you learned from reading the book and the fourth box with what you still want to know.



Earth

What I know



Jupiter

K: What I know

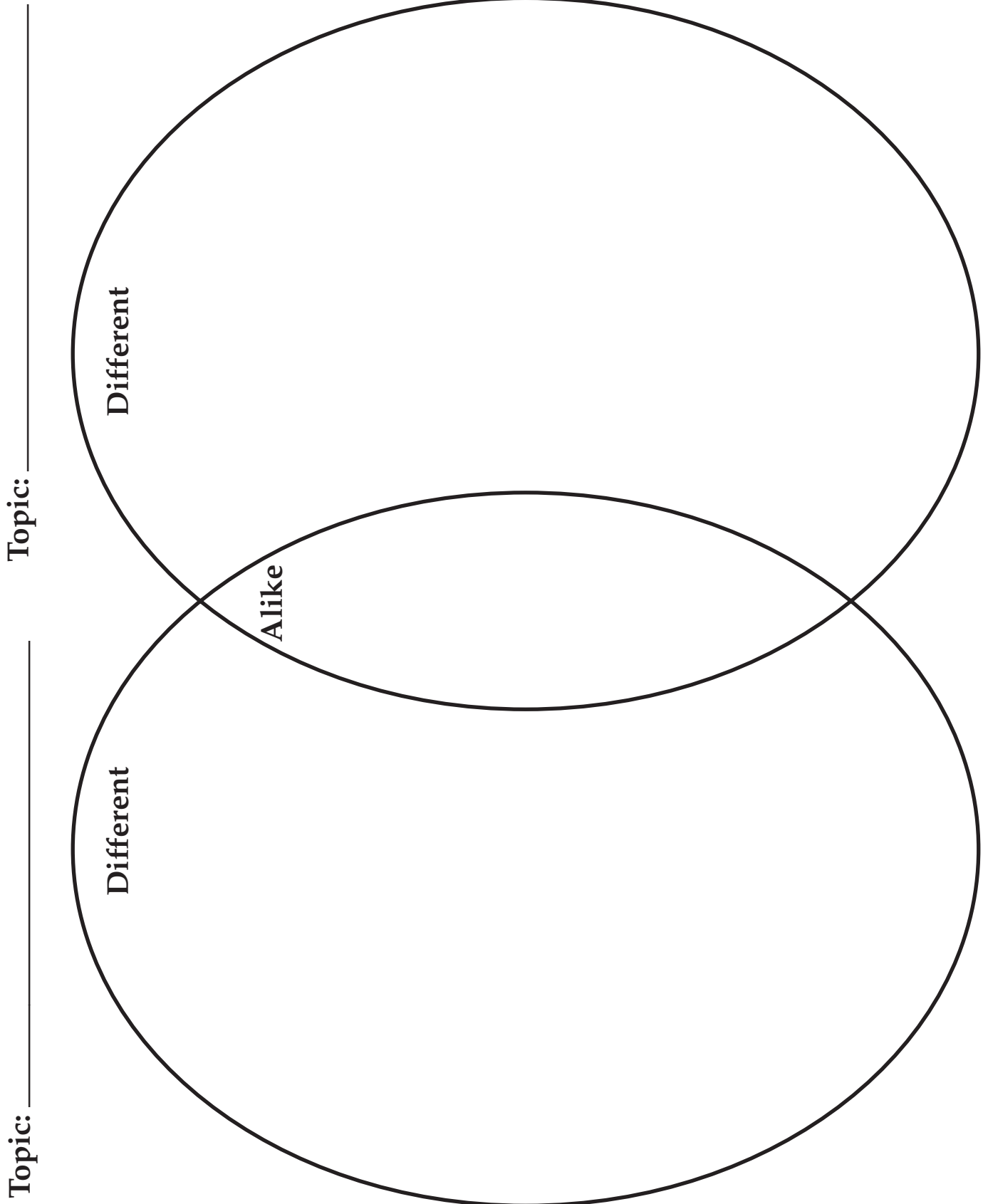
W: What I want to know

L: What I learned

S: What I still want to know

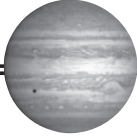
Name _____

Instructions: Use the Venn diagram to compare Jupiter and Earth, using information that you read in the book.

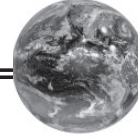


Reading a-z

Jupiter



Earth



JUPITER'S SECRETS REVEALED • LEVEL U • 3

SKILL: IRREGULAR PAST-TENSE VERBS

Name _____

Instructions: Fill in the blanks to complete the sentence for each pronunciation given in *Jupiter's Secrets Revealed*.

1. EYE-oh

The word is spelled _____ and has _____ syllables. The emphasis is on the _____ syllable.

2. GAL-uh-LAY-oh

The word is spelled _____ and has _____ syllables. The emphasis is on the _____ syllables.

3. yu-ROH-puh

The word is spelled _____ and has _____ syllables. The emphasis is on the _____ syllable.

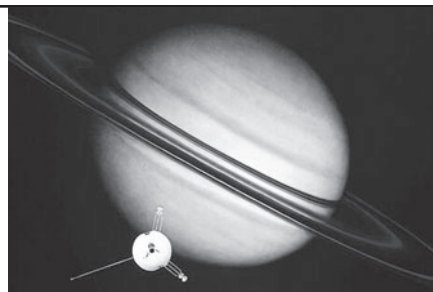
4. GAN-uh-meed

The word is spelled _____ and has _____ syllables. The emphasis is on the _____ syllable.

5. kuh-LIHS-toh

The word is spelled _____ and has _____ syllables. The emphasis is on the _____ syllable.

Much of what we know about Jupiter was discovered by the Pioneer, Voyager, Ulysses, and Galileo spacecraft, which were launched by NASA.



The Jr. Iditarod

A Reading A-Z Level U Leveled Reader

Word Count: 1,843

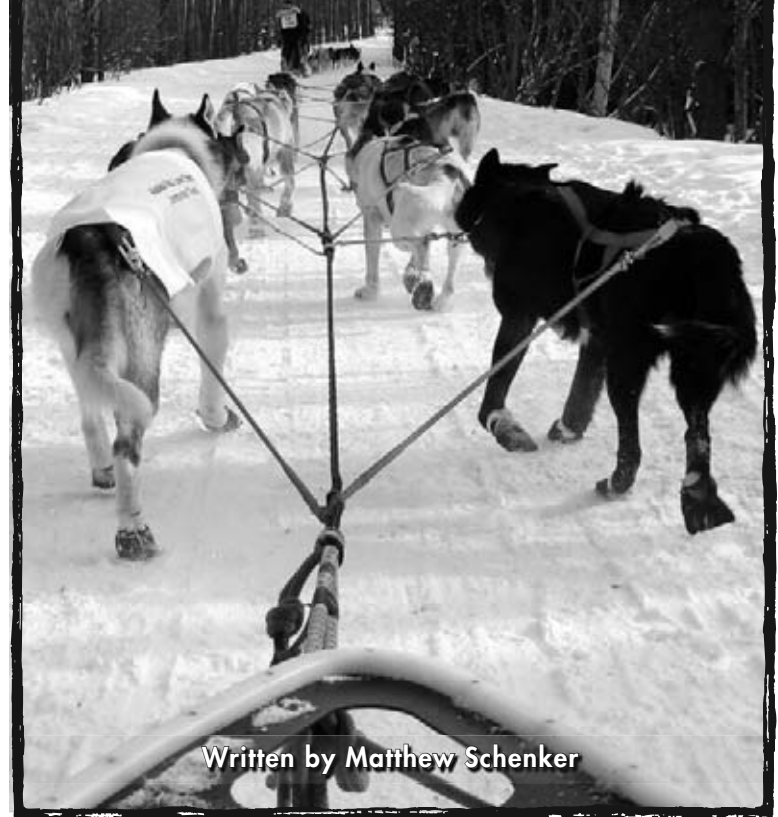


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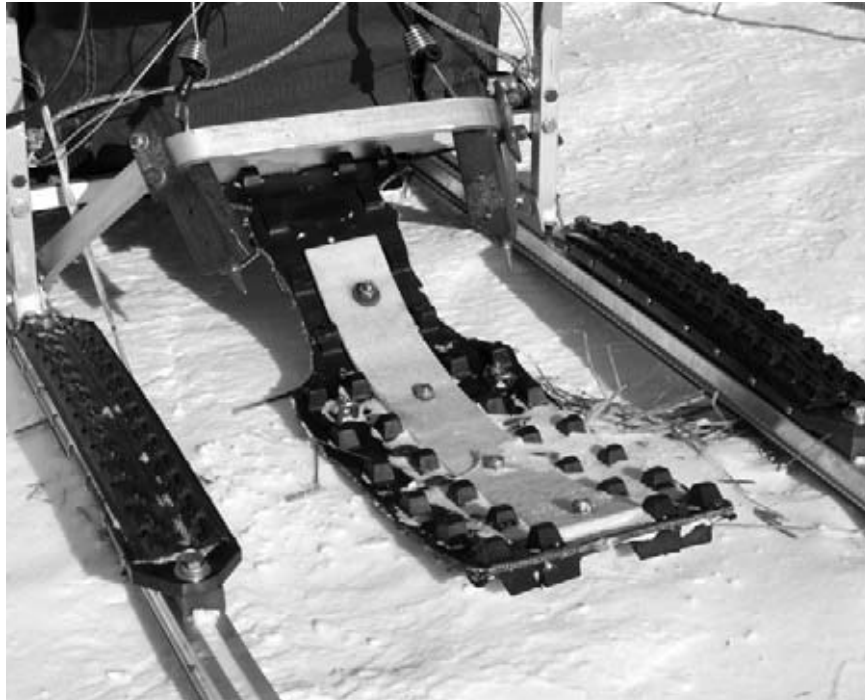


Table of Contents

What Is the Jr. Iditarod?	4
Preparing to Race	5
Ready, Set, Go!	10
Out on the Trail	14
Success!	20
Glossary	23
Index	24



What Is the Jr. Iditarod?

It is late February. Young people ages 14 through 17 gather in Alaska with their dogs for a special race. The participants in the race, called *mushers*, stand on the back end of sleds pulled through snow and ice by a team of dogs. The mushers and their dogs will race across roughly 150 miles (241 km) of challenging **terrain**, braving blizzards, severe winds, and sub-zero

temperatures as they aim for the finish line. This is the Jr. Iditarod, a demanding race that began in 1978 and has taken place every year since then.

Do You Know?

The Jr. Iditarod is modeled after the Iditarod, a sled-dog race that covers over 1,000 miles (about 1,600 km) and may last up to 15 days. Part of the Iditarod route was used in 1925 by mushers and their dogs to deliver life-saving medicine to children in the Alaskan city of Nome. The Iditarod, which began in 1973 to commemorate that event, is a highly competitive race and a popular sporting event in Alaska. The Junior Iditarod helps to prepare young mushers to participate in the Iditarod.

Preparing to Race

Training Together

Mushers begin working toward their goal long before they are old enough to participate in the Jr. Iditarod. Some mushers start training for the Jr. Iditarod at just five years old, packing up supplies and warm clothing, and heading out with their parents onto snowy trails with a team of dogs.

One of the first things young mushers must learn is how to stay safe in the cold. They wear special clothing to keep their hands and faces protected from dangerous winds and below-freezing temperatures.



Proper equipment is essential for mushers.

Another important part of training is mastering a series of commands that mushers teach their dogs. Mushers practice the commands every day with their dogs until the dogs understand and obey each command.

Mushers know from a very young age that they must eat healthy food to be successful at dogsledding—driving a team of dogs that pull a sled. Mushers must be strong to last the full distance of the race. Proper nutrition helps build their muscles and keeps them at their peak performance level.

Dogsledding Commands

gee	turn right
haw	turn left
come gee	turn right 180°
come haw	turn left 180°
whoa	stop
easy	slow down
mush	let's go!
line out	command telling the lead dog to line up the team in a straight line





Mushers bring careful attention to the daily ritual of feeding the dogs.

Caring for the Dogs

Most sled dogs are Alaskan huskies, known for their speed, strength, and **stamina**. In addition to these qualities, mushers want dogs that are friendly and have a positive attitude. Because these are not average dogs, they cannot just eat everyday dog food. Sled dogs require proper nutrition, just as mushers do, to have enough energy for the Jr. Iditarod.

The mushers rise early in the morning to feed their dogs. Mushers prepare special dog food, cooking big pots of rice to which they add fish and a variety of vitamins. Every morning, beginning when the dogs are puppies, mushers follow this strict routine in preparing food for their sled-dog team.



Each dog has a unique personality.

Choosing a Leader

During the year of training leading up to the big race, the mushers have to make an important decision about their dog team. They must determine which dog will be the leader—the dog that shows all the other dogs which way to go. Every member of the dog team is a little different. Just like humans, each one has its own **unique** personality. Some dogs are full of energy, while other dogs are quieter. Some dogs get along better with each other, while others are less **cooperative**.

At each practice session, the musher puts different dogs out in front in the lead position and then watches carefully to see how well the team runs. The next day, the musher moves the dogs around and tries something different. After a while, the musher finds the perfect arrangement that allows the dogs to work together smoothly and run as fast as possible. The lead dog goes in front, and the other dogs line up behind in double-file. The team practices this same arrangement daily, right up to the day of the Jr. Iditarod.



Lining up the dogs

Ready, Set, Go!

The Check-In

The big day of the Jr. Iditarod finally arrives. The mushers arrive in the Wasilla area, north of Anchorage, which is the starting point of the race. They begin to prepare for the race. They put on warm clothing to protect their bodies from



booties

frostbite, a condition where skin gets so cold that it actually freezes. After they dress themselves properly, the mushers get the dogs ready to race. They place special booties on the dogs' feet as protection against the ice and the extremely cold temperatures. Each musher hooks up leads to the front of the sled—long ropes made of strong material that can **withstand** high tension as the dogs pull the sled. Each dog wears a harness, which wraps around the dog's chest. The mushers carefully hook the leads to each dog's harness



until all the dogs are connected together as a team.

The musher gets the harnesses lined up and ready for the dogs.



Checking supplies on a musher's sled

Adults at the race have a checklist of necessary supplies, called the *payload*, that each musher must carry. These adults make sure the mushers have everything on the checklist packed away neatly and securely inside the sleds. Because the race is so challenging, it is crucial that nothing falls out or gets wet during the race. After the check-in is complete, each musher puts on a jersey with his or her official race number.

The Race Begins!

One by one the dogsled teams come to the starting line, with spectators lining the racecourse to watch and cheer. As the mushers **anticipate** the **grueling** race, they are gripped with excitement, and their hearts are pounding as they wait their turn to leave at the two-minute intervals. The event they've been preparing for so **diligently** for years is finally here. The dogs, also excited, eagerly try to pull the sleds forward—they're all ready to race!



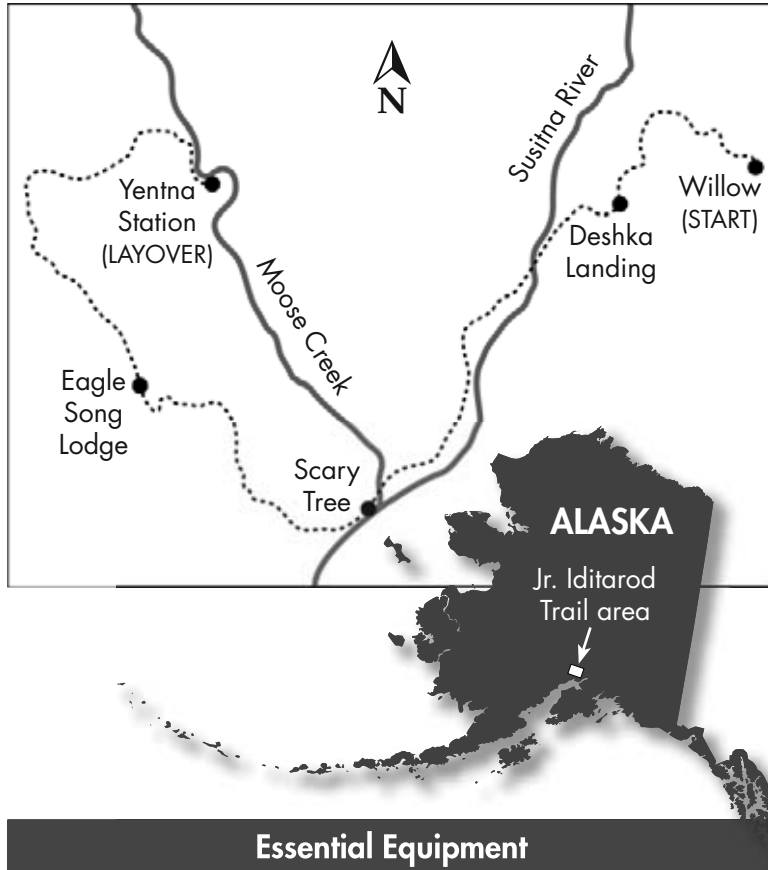
As they wait for the start signal, each musher stands on the brake, a pedal that works like the brakes on a car. For more holding power, the musher also sets a *snow hook*, which is like an emergency brake. Both dig into the snow so the sled doesn't move. When the mushers hear the start signal, they release the brake and pull the snow hook. The dogs yelp and bark as they strain to pull the sled forward. Spectators cheer as the mushers and the dogs take off down the trail. It



only takes a minute before each musher and dog team is out of sight.

A team takes off!

2006 Jr. Iditarod Trail



Essential Equipment

Cold-weather sleeping bag	One day of food for the musher
Hand axe that is at least 22" long	and emergency rations of 3,000 calories
Snowshoes that are 28" long and 9" wide	Five stake-out cables with snaps
Eight booties per dog	Reflective tape material
Head lamp	Matches or lighter
Alternate light	Dog food cooker
Restraint to hold dog(s) in sled	Three pairs of socks
Two pounds of dog food	Rain gear
	Three pairs of gloves

Out on the Trail

Staying on the Trail

Even though the dogs have been training for years, the race is very challenging. It is the mushers' responsibility to make sure the dogs stay on the trail. Mushers watch for markers in



Markers help mushers stay on the trail.

the ground every few yards, which help them see the trail. The markers—wooden sticks

with bright orange tips—are placed along the entire route of the race. The sleds have headlamps, which light up the trail and help the mushers see the markers during snowstorms and at night.

Long stretches of the racecourse are straight and flat, but then a sharp turn or a very steep hill will suddenly appear in front of the team. Mushers have to drive their sleds through soft and hard snow, over frozen rivers and rocky ground, and through forests. All the while, they're shouting commands to the dog team while trying to see what lies up ahead and staying alert enough to be able to respond quickly.

The dogs don't do all the work. On flat ground, the mushers kick with their feet to help push the sled forward. Going up a hill, the mushers get off the sled and help by pushing the sled. If the mushers don't stay focused on the trail, they are in danger of sliding off the trail and losing valuable time.

The weather can be **brutal**—temperatures can drop to -50 degrees Fahrenheit (-46°C), and the wind can be so cold that it stings a musher's face. Mushers and dogs are able to **endure** all these challenges and conditions because they have had years of exercise, good nutrition, and special training.



One team is about to overtake another.

Supporting Each Other

Each musher pushes his or her team to go as fast as it can and to win the race. But there is more to the Jr. Iditarod than just winning. If a musher is racing along, another musher may come up behind and yell *trail!* That means the musher in front has to move over and let the other musher pass. This is called *giving trail*, and mushers must obey the rule. Any musher who doesn't move over is automatically disqualified from the race.

Mushers are always concerned about each other's safety and well-being. If a musher is in danger in any way, other mushers will stop to help—even if it means losing the race. The code of **ethics** among fellow mushers places a higher **priority** on helping each other than on winning.

Checkpoints

Every so often, mushers stop at *checkpoints*, or stations along the trail where adults, called *checkers*, make sure the mushers are healthy and have enough supplies. Veterinarians at the checkpoints make sure the dogs are in good health. Mushers also have their own *checkpoint routine* to follow. They inspect the dogs' booties and walk around the sleds to make sure all the leads and harnesses are in proper condition. They also check their jackets, gloves, and hats, replacing them if wet or torn. Mushers and dogs only spend as much time as needed at checkpoints, eagerly returning to the trail to continue the race.



A musher goes through a checkpoint.



Mushers share friendship bonds during layovers.

The Layover

When the mushers reach Yentna Station, the halfway point of the race, every musher must stop. They are required to take a ten-hour break, called a *layover*. The mushers rest, eat good meals, and take care of their dogs. The first-place musher arrives at Yentna Station and starts a bonfire. It is a tradition that as the other mushers come in to Yentna Station, they sit together around the bonfire. They all share food with each other, and even more, they share stories. Each musher has an opportunity to describe something that happened out on the trail or tell a funny story about his or her dogs.

Heading Back

After ten hours, the first-place musher gets back on the sled and races away from Yentna Station. The other mushers follow in the order in which they arrived. After leaving Yentna Station, the mushers race back to the starting point of the race over the same trail they followed to get there. They go through each of the same checkpoints they stopped at on the way to Yentna Station.



Mushers and their dogs are often the only life along the trail.

Success!

After the mushers pass the last checkpoint of the race, they are in the home stretch—the last and most exciting part of the race. As they near the end of the race, they can see the sign bearing the words “Finish Line.” This is the moment they have been training for, and they use all the energy they can **muster** in a mad dash to the finish.

The first musher to cross the finish line wins the race. Spectators who have gathered to watch the end of the race cheer as each team appears.



2003 winner Ellie Claus nears the finish line.



Ellie Claus and her dogs pose for a photograph.

After the last team crosses the finish line, all the mushers get together to receive their awards for completing the race. The mushers congratulate each other, no matter how they finish, because they recognize how challenging the Jr. Iditarod is for every participant. They have every reason to be proud of themselves and their dogs after all the long hours of training and hard work. They know that each musher's team worked together to complete this incredible race and that they all worked alongside each other as well. Each musher feels proud that a challenge was laid down and met. In this way, every participant in the Jr. Iditarod is a winner.

Year Musher

1978	Joe Good, Division I; Mike Newman, Division II
1979	Clint Mayeur
1980	Gary Baumgartner
1981	Christine Delia
1982	Tim Osmar
1983	Tim Osmar
1984	Tim Osmar
1985	Lance Barve
1986	Lance Barve
1987	Dustin VanMeter
1988	Dan Flodin
1989	Jarad Jones
1990	Jarad Jones
1991	Brian Hanson
1992	Ramey Smyth
1993	Ramey Smyth
1994	Cim Smyth
1995	Dusty Whittemore
1996	Dusty Whittemore
1997	Tony Willis
1998	Charlie Jordan
1999	Ryan Redington
2000	Ryan Redington
2001	Tyrell Seavey
2002	Cali King
2003	Ellie Claus
2004	Nicole Osmar
2005	Melissa Owens
2006	Micah T. Degarlund



Which musher has won the most times?

Glossary

anticipate (<i>v.</i>)	think about in advance (p. 12)
brutal (<i>adj.</i>)	extremely difficult to cope with (p. 15)
cooperative (<i>adj.</i>)	willing to work together (p. 8)
diligently (<i>adv.</i>)	working hard and doing a thorough job (p. 12)
ethics (<i>n.</i>)	moral principles that guide a person's behavior (p. 16)
endure (<i>v.</i>)	to live through something challenging (p. 15)
grueling (<i>adj.</i>)	very difficult; exhausting (p. 12)
muster (<i>v.</i>)	summon; bring forth (p. 20)
priority (<i>n.</i>)	importance (p. 16)
stamina (<i>n.</i>)	the ability to exert physical or mental strength to complete a task (p. 7)
terrain (<i>n.</i>)	land; ground (p. 4)
unique (<i>adj.</i>)	one of a kind; unlike others (p. 8)
withstand (<i>v.</i>)	not be damaged or affected by (p. 10)

Index

Anchorage, 10	participants, 11, 21
conditions, 14, 15	sled dogs, 7–9
distance, 4, 6	spectators, 12, 20
finish line, 19–21	starting line, 10, 12, 19
halfway point, 18, 19	training, 5
history, 4	



Reading a-z

THE JR. IDITAROD • LEVEL U • 1

SKILL: MAIN IDEA AND DETAILS/SUMMARY

Name _____

Instructions: Read each sentence. Choose two words from the box that create a hyphenated compound adjective that completes the sentence. Write the new word in the blank space and underline the noun that each adjective describes.

life	double	place	first	ten
sled	hour	saving	dog	file

1. The sled dogs are arranged in a _____ line.
2. The dogs delivered _____ medicine to the children in the Alaskan city of Nome.
3. Racers are required to take a _____ break, called a layover.
4. Mushers follow a strict routine in preparing food for their _____ team.
5. The _____ musher arrives at Yentna Station and starts a bonfire.



Name _____

Instructions: Cut apart the word cards below. Put a dot over each vowel and then draw a slash to show where the word is divided into syllables. Sort the word cards into two piles according to the first syllable in each word: open syllables or closed syllables.

gather	taken	driving
popcorn	member	sunset
final	behind	seashell
treetop	pancake	frozen



Weaving Around the World

A Reading A-Z Level U Leveled Reader

Word Count: 2,022




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Front cover: Geometric shapes and stripes are just some of the patterns made using weaving. This is a Bedouin weaving.

Back cover: Maya teenagers attend Day of the Dead celebrations in traditional woven clothing.

Title page: A Peruvian woman weaves using a foot loom.

Weaving Around the World
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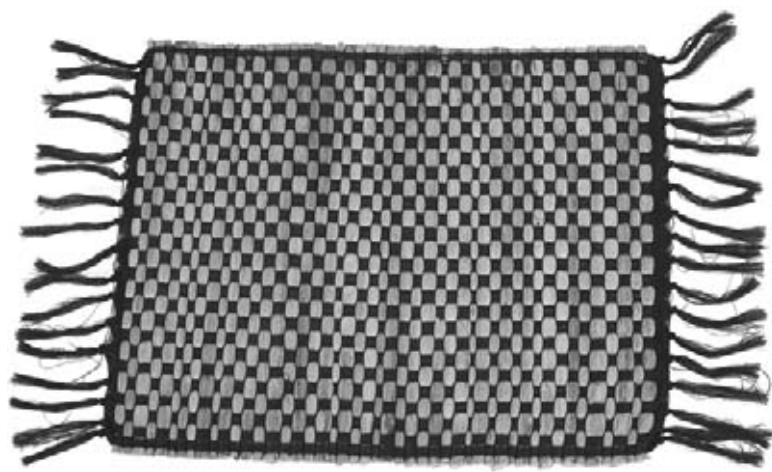


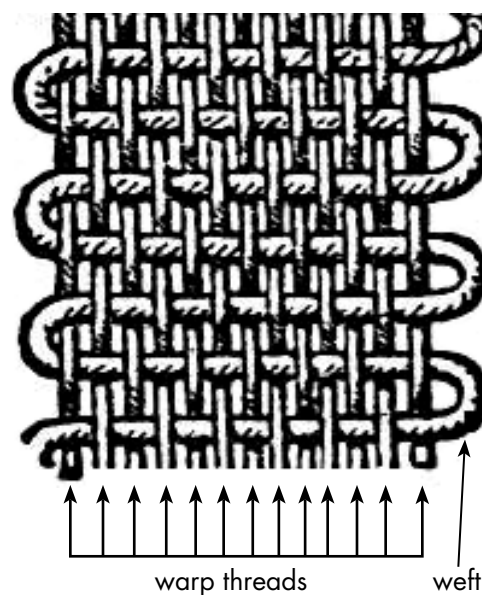
Table of Contents

Introduction	4
How We Began Weaving.....	5
Weaving Around the World	9
North America	10
Latin America	12
Europe	14
Asia.....	16
Africa	18
Oceania.....	20
Explore More	21
Conclusion	22
Glossary.....	23

Introduction

The art and craft of weaving are responsible for an amazing variety of objects in our world. These include everyday items such as clothing fabric, sheets, blankets, and towels, as well as fine museum tapestries and other artistic expressions. Woven fibers are strong. Our earliest ancestors found that woven nets caught more fish at one time than did hooks or spears. Woven ropes made it easier to pull or carry large objects. Strips of leather could be woven and shaped into vests, belts, and bags.

Weaving is the process of creating fabric by lacing together two sets of threads. The **warp** is a set of threads that are held in position by tension,



either on a device called a loom, or by gravity with the help of a weighted object—like a rock, a board, or even a tree branch. The **weft** is a set of threads that the weaver laces over and under the warp and then packs together tightly.

How We Began Weaving

Woven items have existed since the dawn of human history. Every area of the world has developed its own style of weaving—its own materials, patterns, and colors. Weavers have always used whatever materials were available to them locally: yarn, string, wool, silk, cotton, plants, and grass.



This vertical loom is modeled after an ancient Viking loom.

Our earliest ancestors gathered natural resources for food, shelter, and clothing. But one day, someone was inspired to try something new. Perhaps he noticed how the elaborately woven nests of the weaver bird protected its eggs. He may have taken a nest apart to see how it was constructed. Or he saw how the wind had matted together blades of grass after a storm. Or perhaps the first attempts at weaving happened after someone saw how snugly the fingers of her hands braided together.

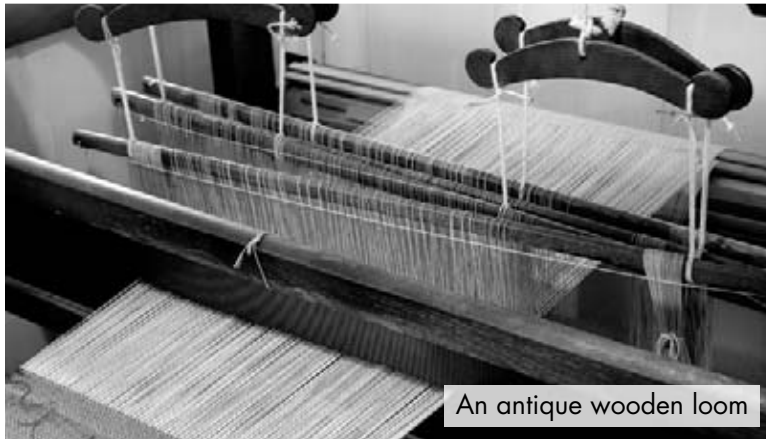
Once people began to experiment, the uses for weaving multiplied. The first woven objects were intended to make life easier. By bending grasses and reeds, and adding leaves, people made simple mats. Mats could be used for floors, roofs, or walls, or to carry things. Over time, people developed skills and weaving traditions that were passed down from generation to generation.

Weaving techniques experienced an important leap forward 20,000 to 30,000 years ago when people discovered that they could make fine string by twisting together thin bundles of plant material. This development was the foundation of sewing and **spinning**, as well as more advanced weaving techniques.

Between 8,000 and 3,000 BC, the first simple looms were invented. The frame of the loom held warp threads firmly in place while the weft threads



An 1879 engraving of a weaver in India



An antique wooden loom

were alternated over and under them. One early loom used poles placed in the ground onto which the warp was tied. Another style of loom used clay or stone weights to create warp tension.

People continued to use these simple weaving techniques for thousands of years to make cloth for household use. But weaving underwent an important change with the invention of a more complicated loom.

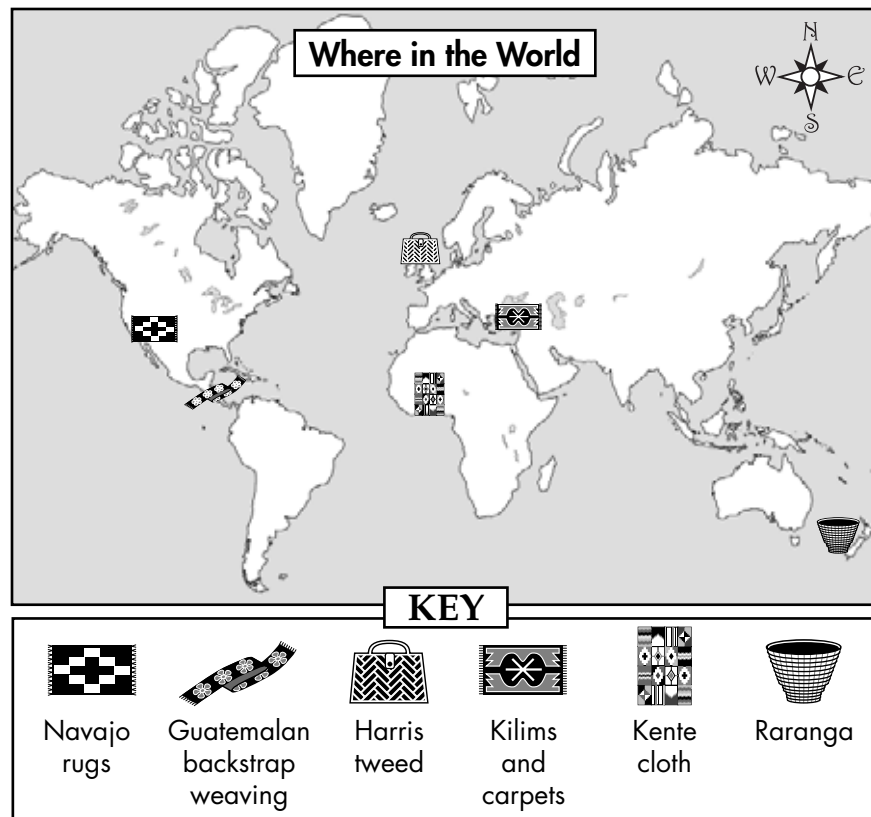
New weaving technology was invented in China during the Shang Period (1766 to 1122 BC). Someone had the idea to feed the warp threads through individual needlelike devices attached to crossbars. A lever operated by foot or hand controlled these bars. Lifting some warp threads but not others created a **shed**, an opening between groups of warp threads.

For the first time, a weaver could pass a spool of thread between groups of warp threads instead of having to lift them one at a time. This development **mechanized** weaving enough that weavers could produce much larger quantities of cloth than with earlier looms. This Chinese loom design is the basis of all modern looms.

Later developments in loom design allowed for the creation of **intricate** patterns, as well as even more efficiency and higher productivity. During the Industrial Revolution (late 1700s to early 1800s), the weaving of cloth became a mechanized industry. As new loom technology greatly increased the amount of cloth that could be produced, the spinning industry expanded to keep up with the greater demand for yarns.



This loom from about 1890 is still used to make fabric at the American Textile History Museum.



Weaving Around the World

Today, most **textiles** are made by automated machines. However, many **artisans** around the world still weave on handlooms or in small weaving businesses. These people keep alive the tools, skills, and craft traditions of weavers from long ago. Let's look at some of the cultures that create works of great beauty using traditional weaving techniques.

NORTH AMERICA—NAVAJO RUGS

The Navajo settled in present-day northern Arizona and New Mexico more than 600 years ago. In this arid region of mountains and open spaces, they developed a nomadic lifestyle that focused on raising sheep for food, wool, and clothing. Following a period of conflict with the United States in the mid-nineteenth century, the Navajo moved to a reservation that covers parts of Arizona, Utah, and New Mexico.

Navajo weaving began through contact in the 1600s with Pueblo tribes who lived just east of the Navajo. Weaving was a men's task in Pueblo culture, but among the Navajo it became a women's specialty. For two centuries, weavers created practical clothing items such as ponchos and belts. They used patterns from their own basketry traditions as well as designs borrowed from other tribes.

Do You Know?

The Navajo Nation is the largest Native American tribe in the United States, with more than 250,000 members.



Navajo textiles for sale



A Navajo woman weaves a rug. What else in this photograph appears to be woven?

As contact with white traders and settlers increased in the late 1800s, new techniques, yarns, and dyes influenced Navajo weavers. Increased contact also meant more trade and a greater demand for items and patterns that were popular with buyers. In response, weavers began to make wall hangings and decorative rugs rather than clothing. Although weaving styles have changed through the years, Navajo weaving continues to be some of the finest cultural artwork in the world. It is also an important source of income for the tribe.

Latin America— Guatemalan Backstrap Weaving

The Mayan civilization, which reached its peak around AD 300 to 900, was centered in the Central American country of Guatemala. The modern descendants of the Mayas make up close to half of the country's population. Many of these people live in mountain villages that are fairly isolated from the modern world.

Guatemalan weavers have created vibrantly colored textiles on the **backstrap loom** since before the time of European contact in the 1520s. This kind of loom is anchored to a tree at one end and to the weaver's body at the other end. The weaver leans forward to loosen warp tension and lift warp threads, and leans back to tighten the warp and pack down the weft.



A Guatemalan woman weaves using a backstrap loom.



Many of the more complex patterns take many years to master.

In addition to vibrant colors, this form of Guatemalan weaving is known for its animal and nature **motifs** as well as unique geometric patterns. Backstrap weaving is a women's tradition taught by mothers and grandmothers to girls when they reach the age of seven or eight. Weaving allows girls and women to display their artistry as well as their dedication to cultural traditions. Woven cloths are made into blouses, shawls, belts, bags, all-purpose cloths for carrying babies or goods, and other items.

Europe (Scotland)—Harris Tweed

Imagine a string of remote northern islands with rugged coastlines, treeless hills, and uncountable numbers of sheep. Harris **tweed**, one of the highest-quality woolen textiles in the world, is made from wool that is dyed, spun, and woven on a group of islands off the northwest coast of Scotland called the Outer Hebrides (HEH-bruh-deez). The islanders preserve their Gaelic culture and language, and many have not ventured off the islands for decades.

Long ago, weavers used an early type of loom that was operated by hand. Technological advancements around 1900 had an important impact on Harris tweed weaving, which up to that point had been done mostly by women. Because the new, heavier kind of loom required greater strength to operate it, the making of Harris tweed became mostly a men's activity. As technology continued to develop, weavers began producing larger quantities of textiles.



A man weaves Harris tweed in 1955.

A traditional Harris tweed loom in the 1980s; a handbag made with Harris tweed



Around the same time, Harris tweed began to be inspected, and a certification process created confidence in its quality, which boosted sales. Advances over the years have allowed weavers to produce their product more efficiently. Still, the centuries-old island tradition of weaving Harris tweed by hand has withstood the Scottish mainland trend to mechanize.

Asia~Turkish and Persian Kilims and Carpets

Turkish and Persian rugs are known throughout the world for their amazing beauty and intricacy. The tradition began at least as far back as 7,000 BC and has evolved into a variety of weaving styles and patterns, each associated with a specific region. This part of the world was once the center of the Ottoman Empire, one of the largest empires ever known. The area includes a rich **diversity** of people, races, languages, religions, and cultures that have **intermingled** for many centuries. This diversity is reflected in the variety of weaving traditions, which have generally been a women's activity.



Women make carpets in Turkey.



Carpets for sale in Morocco

Kilims and carpets use two different weaving techniques. Kilims are **flat weaves**, meaning they use a basic combination of warp and weft threads to create intricate geometrical patterns. Kilims have been made for centuries by villagers and tribal members for everyday needs such as decoration, wrapping, room dividers, and floor coverings.

Carpets are **raised weaves**, which use a combination of weaving and knotting to create densely packed rugs that are thick and heavy. Many carpets have floral or other nature patterns. Traditionally, carpets have been used for floors, beds, and prayer. The motifs of both kilims and carpets relate to cultural origins and traditions, making the rugs symbols of heritage as well as useful and decorative items.

Africa—Kente Cloth (Asante and Ewe Weavers of Ghana)

Kente cloth is a ceremonial cloth made in the countries of Ghana and Togo by the Asante and Ewe peoples, particularly the men. Kente cloth is meant to be worn for special social and religious events. Vibrant and bold in color and design, the cloth is woven in long strips three to eight inches wide. The strips are cut into shorter lengths and sewn together to make larger pieces of cloth.



This boy wears a 50-year-old Kente cloth robe.

Kente cloth is more than just fabric for clothing—it represents the culture, spiritual beliefs, and traditions of the Asante and Ewe peoples. Warp threads and weft designs each have a name and meaning that reflect beliefs, historical events, social organization, or other aspects of the culture. Long ago Kente cloth was only for royalty, but over time it has

become available to everyone. It is an important symbol of cultural pride.



Different types of Kente cloth on display in Ghana. A weaver works on a length of Kente cloth (inset).

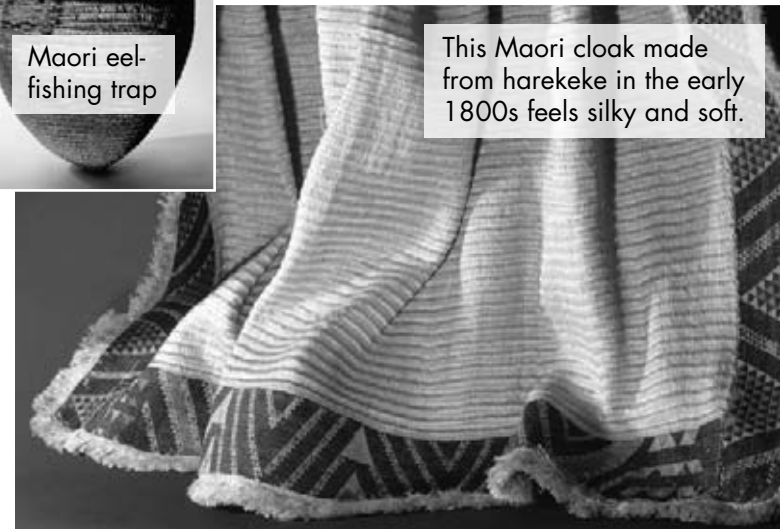
Oceania—Raranga (Maori Flax Weaving)

Raranga is a traditional Polynesian weaving technique of the Maori (MOU-ree), the native people of New Zealand. Although the technique is called flax weaving, the plant, called *harekeke* (HAY-ree-KEY-key), is actually a kind of lily and not true flax. Harekeke is an exceptionally strong material that the Maori have used for at least one thousand years to create mats, baskets, bags, clothing, and other items. Maori weaving has

always been mostly a women's art. However, men have developed ways to use harekeke for building and for hunting and fishing, such as to make ropes and fishing lines.



Maori eel-fishing trap



This Maori cloak made from harekeke in the early 1800s feels silky and soft.

Explore More

Other weaving traditions you might want to learn more about include:

- Indonesian ikat
- Japanese Kasuri weaving
- Nepalese inlay weaving
- Peruvian tapestry weaving
- Ie-Toga—Samoan fine mat weaving
- Silk weaving in India, France, and China

You can also use Google or another search engine to search for *weaving traditions* or *traditional weaving*.

The Maori, along with other traditional Polynesian peoples, believe that the gods express their creativity through individual artisans. Raranga, therefore, has a spiritual dimension as well as an everyday function. In addition, this weaving tradition has been passed down from Maori ancestors and is a strong symbol of tribal traditions. The Maori suffered oppression and lost much of their land during a harsh colonial era. Raranga is living proof that their culture has survived. This weaving tradition symbolizes the unity of the Maori people and the wholeness of all creation.

Conclusion

The cultures and weavers in this book represent just a few of the vast number of weaving traditions around the world. Each tradition reflects a people's native materials, everyday needs, and cultural symbols. When you see items woven by hand in a museum, art gallery, or ethnic shop, keep in mind that each piece tells a story about the long-standing traditions of the weaver's culture. Many of these cultures continue to thrive, even in the face of global modernization.

As you go about your everyday life, notice all the woven items you use. Imagine what you might wear if fabric for clothing didn't exist. Imagine if you didn't have sheets, blankets, or towels. Even the cloth produced by automated



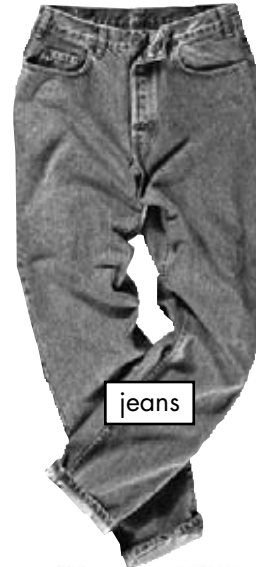
This 2003 weaving machine can weave complex patterns quickly.

looms tells a story about the creative people who invented ways to convert plant fibers into fine fabrics.

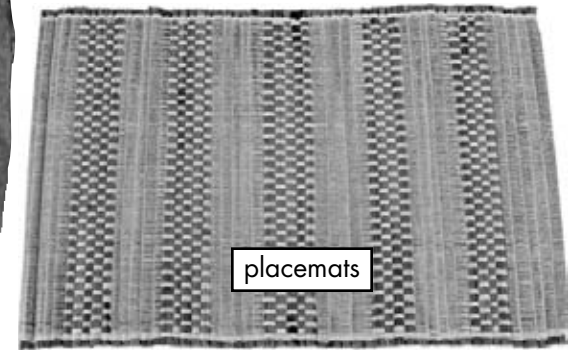
Glossary

artisans (<i>n.</i>)	people who are skilled at a craft or trade and create items by hand (p. 9)
backstrap loom (<i>n.</i>)	a hand-weaving loom that wraps around a tree on one end and the weaver's body on the other (p. 12)
diversity (<i>n.</i>)	variety (p. 16)
flat weaves (<i>n.</i>)	woven items made with warp and weft threads, without knotting (p. 17)
intermingled (<i>v.</i>)	mixed together (p. 16)
intricate (<i>adj.</i>)	very detailed or complicated (p. 8)
mechanized (<i>v.</i>)	introduced machines into the production process (p. 8)
motifs (<i>n.</i>)	a story or decorative theme told by a design or a pattern (p. 13)
raised weaves (<i>n.</i>)	woven items made with a combination of threads and knots (p. 17)
spinning (<i>n.</i>)	the process of making thread or yarn from raw fibers (p. 6)
shed (<i>n.</i>)	the space between warp threads where weft threads pass through (p. 7)

textiles (<i>n.</i>)	cloth; woven fabric (p. 9)
tweed (<i>n.</i>)	a woolen cloth with a rough surface and flecks of color (p. 14)
warp (<i>n.</i>)	the vertical threads that are the foundation of a woven piece (p. 4)
weft (<i>n.</i>)	the horizontal threads added to create a woven piece (p. 4)



jeans



placemats



bags

Name _____

Instructions: Before reading the book, read each statement and predict whether it is true or false based on what you know about weaving. When you have finished reading the book, revise or confirm your answers in the third column.

Statements	True or False	Revise or Confirm Your Prediction
❶ Woven fibers are beautiful but not very strong.		
❷ Early humans began weaving with grass, reeds, and leaves.		
❸ The first loom was invented by the Chinese.		
❹ Navajo men are in charge of weaving rugs.		
❺ Guatemalan weavers use their body as part of the loom.		
❻ Harris tweed is woven by Scottish islanders who may not have left their island in decades.		
❼ In the past, African Kente cloth could be worn only by royalty.		
❽ The Maori people use a kind of flower to create their weavings.		

Name _____

Instructions: As you read about weaving traditions around the world, fill in the chart below to help you compare them.

Country	Type of Weaving	Traditionally made by women or men?	Religious or Cultural Tradition? Yes/No

Name _____

Instructions: Read the sentences below. Identify the *independent clause*, the *dependent clause*, and the *conjunction* in each complex sentence, and write them on the lines provided.

- ① As new loom technology greatly increased the amount of cloth that could be produced, the spinning industry expanded to keep up with the greater demand for yarns.

Independent clause: _____

Dependent clause: _____

Conjunction: _____

- ② Backstrap weaving is a women's tradition taught by mothers and grandmothers to girls when they reach the age of seven or eight.

Independent clause: _____

Dependent clause: _____

Conjunction: _____

- ③ Because the new, heavier kind of loom required greater strength to operate it, the making of Harris tweed became mostly a men's activity.

Independent clause: _____

Dependent clause: _____

Conjunction: _____

- ④ Although weaving styles have changed through the years, Navajo weaving continues to be some of the finest cultural artwork in the world.

Independent clause: _____

Dependent clause: _____

Conjunction: _____

- ⑤ As technology continued to develop, weavers began producing larger quantities of textiles.

Independent clause: _____

Dependent clause: _____

Conjunction: _____

How to Build a Greenhouse

A Reading A-Z Level U Leveled Reader

Word Count: 1,491




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How to Build a Greenhouse



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Table of Contents

Introduction	4
The History of Greenhouses	6
How Greenhouses Work	9
Finding a Good Location	10
Building a Cardboard Box Greenhouse	12
Tips for Greenhouse Care	18
Conclusion	19
Glossary	20

Introduction

For decades, gardening ruled over all other **hobbies** in the United States. Even difficult winter weather **conditions**—heavy rains, harsh winds, fierce hail, deep snow—could not keep many people from doing what they enjoyed. People have looked to indoor gardening as a way to maintain or enhance their hobby for hundreds of years. Indoor gardening allows people to keep plants growing for months when outdoor conditions make it difficult, and often helps crops of vegetables and flowers to be grown year-round.



Plants are fully protected from the cold in the indoor greenhouse (above) and receive some protection outdoors with these glass covers (left).

One type of indoor gardening uses a **greenhouse** to grow plants throughout the year. Greenhouses keep out varying weather conditions and temperature extremes, and preserve ideal conditions for plants to grow. The roof and walls of a greenhouse are usually made of glass or plastic. The **humidity** is kept fairly high, natural light is at a maximum, and carbon dioxide is trapped inside for plants to breathe. Some gardeners grow their entire crop in a greenhouse, while others use it to **germinate** plants before moving them outside.



The History of Greenhouses

Greenhouses have been used since ancient Rome. Legend has it that in AD 30, the Roman emperor Tiberius became ill. His doctor recommended that the emperor eat a cucumber every day in order to regain his health. This presented a challenge to Tiberius's gardeners. How could they keep the green vegetable growing all year long? They decided to plant the cucumbers in large clay pots and cover them with a thin, glass-like mineral called mica. The mica greenhouse was able to gather sunlight, keep the soil moist, and protect the cucumbers from temperature changes.

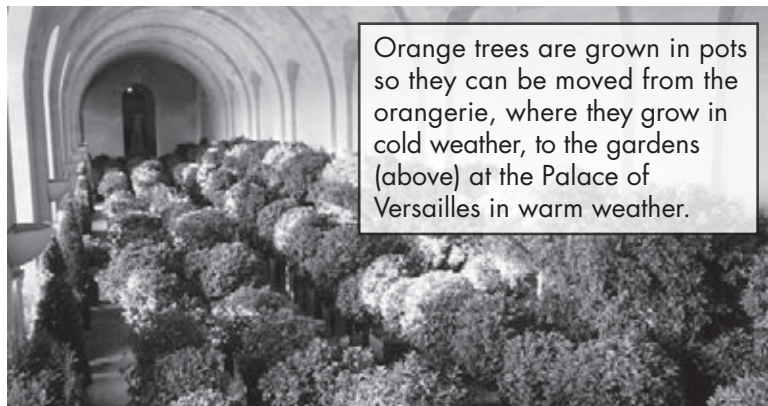
Hundreds of years later, in the sixteenth century, Europeans began exploring and trading with people from various places all over the world. Many Europeans would often return home with new and unique plants. However, those plants often could not survive the colder, and sometimes harsh, European **climate**. In order to keep those rare plants alive through the winter, a shelter was designed to keep them growing. The people of Italy were the first to construct what we consider modern greenhouses. Holland and England followed closely behind.

The creation of greenhouses sparked an upsurge of interest in **botany**, or the study of

plants. Colleges and universities, and even average gardeners, began trying to collect, **classify**, and grow—or at least keep alive—all the known varieties of plants.

The people of France in particular had a fascination with one foreign plant: the orange tree. They began

constructing “orangeries” to protect this fruit, native to warmer climates in Asia, from frost. During the seventeenth century, using new technology and improved glass, the French began redesigning their greenhouses in style and size—the largest and most ornate at the time being one at the Palace of Versailles, which was over 500 feet long, 42 feet wide, and 45 feet high.

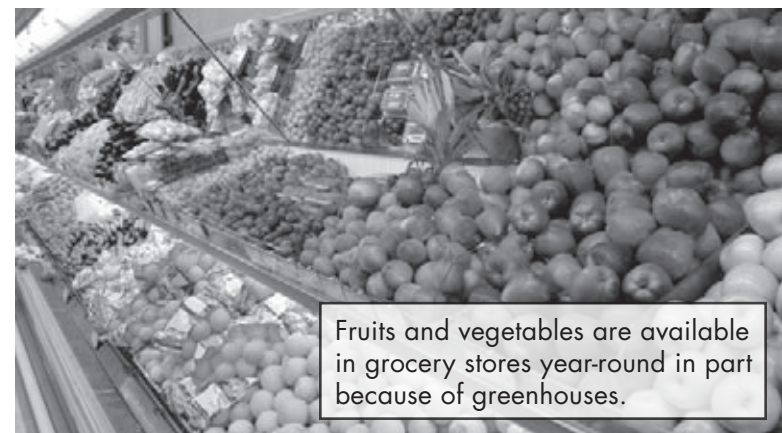


Orange trees are grown in pots so they can be moved from the orangerie, where they grow in cold weather, to the gardens (above) at the Palace of Versailles in warm weather.



Workers check the watering system in this flower greenhouse.

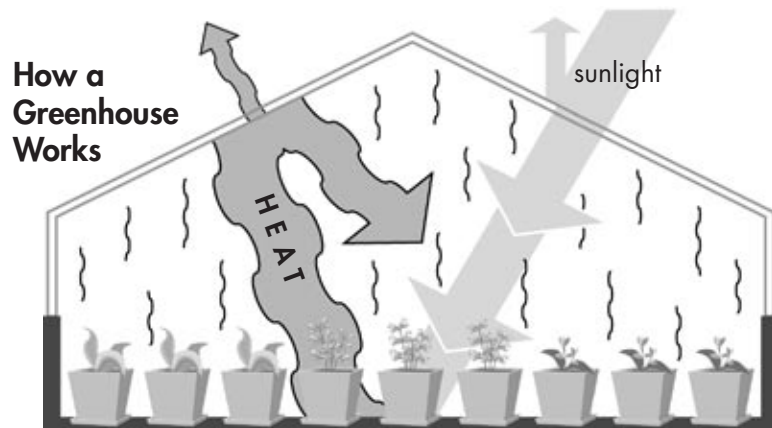
Today greenhouses are used around the world to supply stores with food and flowers year-round. Grocery stores can now stock fruits and vegetables year-round instead of just during the season when they mature in nature. Spring flowers can now be sold by florists in the middle of winter.



Fruits and vegetables are available in grocery stores year-round in part because of greenhouses.

How Greenhouses Work

Greenhouses allow plants to grow fuller and faster than if they were outdoors, exposed to the weather. How can a simple structure of glass (or plastic) do that? A lot depends on the light. Light has different **wavelengths**. The short waves from the Sun pass through the glass. The plants use this light to convert carbon dioxide and water into food, which allows them to grow. This process is called **photosynthesis**. Once inside the glass, the Sun's light is absorbed by the plants and other materials in the greenhouse. The plants and materials release the extra energy gained from the Sun's light as heat. This heat, which is a longer wavelength, cannot pass back through the glass, so it acts like a blanket, raising the temperature and humidity of the greenhouse to ideal growing conditions.



Heat radiates from all surfaces in a greenhouse.

Finding a Good Location

Before picking up the tools and supplies to build a greenhouse, you must find the best location in your house or yard. The greenhouse you will build using this book works best inside your house, but many greenhouses are separate buildings or are attached to the outside of an existing building. When choosing a location inside, there are three major factors to consider: sunlight, heat, and ease of use.

First, you should ideally find a window that faces south or southeast to give your greenhouse maximum sunlight.



If that's not possible, find an east-facing window for at least morning sunlight so that photosynthesis can begin and continue throughout

the day. Second, the window you choose should be away from furnace vents or other heat sources, as your greenhouse will be warm enough with the right amount of sunlight. Third, you should put your greenhouse in a place where you can easily check on your plants but where it will not be disturbed by other daily activities.

Choosing a Greenhouse Location Outside

When choosing a location outside, consider three factors:

1. Sunlight: Spend a day observing the shade created in your yard before placing your greenhouse. The greenhouse should receive as much sunlight as possible throughout the day.

2. Drainage:

Choose a spot with natural drainage or a place that is on higher ground so that rainwater can drain properly.

3. Wind: Find a place where your greenhouse can be sheltered from cold winter winds. This might be along the side of your house or within a group of deciduous trees (which will protect it from cold winter wind and intense sunlight on summer afternoons). Just make sure your greenhouse still receives plenty of light in the winter.



Building a Cardboard Box Greenhouse

Many greenhouse designs can be constructed over a weekend at a fairly low cost. Some are simple, while others are complex. All of them

require patience, focus, and a willingness to have fun. The following greenhouse is a bit unconventional. It's smaller—in the space of a cardboard box—than the average greenhouse and can be enjoyable to make with a parent or family member as a weekend project.



Materials

- 1-12"x12"x16" cardboard box
- utility knife or scissors
- ruler
- pencil
- 2 square feet of aluminum foil
- craft glue
- gray duct tape
- potting soil
- small plant pots
- seeds
- water
- 10 wooden clothespins or small binder clips
- small rocks or stones, enough to make a 1" layer in your box
- 2-24"x 36" sheets of clear plastic film at least 1.75 millimeters thick and up to 6 mm thick



Construction

- 1 Use the ruler and pencil to measure and mark 4 inches up from the bottom of the cardboard box along the 12-inch side. Make a couple of marks. Draw a straight line across the box at the 4-inch marks you made, being sure to draw the line about an inch or two around the corners to each long side of the box.



- 2 Use the ruler and pencil to draw a diagonal line from the 4-inch line on the long sides up to the opposite corner at the top of the box so your box appears to be almost two triangles. Cut along the lines you have drawn.

3 Spread the craft glue on the bottom and sides of the box. Work quickly so the glue does not dry or glue a section of the box at a time.



4 Line the inside of your box with the aluminum foil, tearing or cutting it to fit and then pressing it in place over the glue. Be sure the shiny side of the foil faces into the box.

5 Line the bottom of your box with one of the plastic sheets, being sure to tuck it into the



corners as much as possible. Use the duct tape to attach the plastic to the box where the plastic and aluminum foil meet. Be sure the glue on the foil is dry before using the tape.

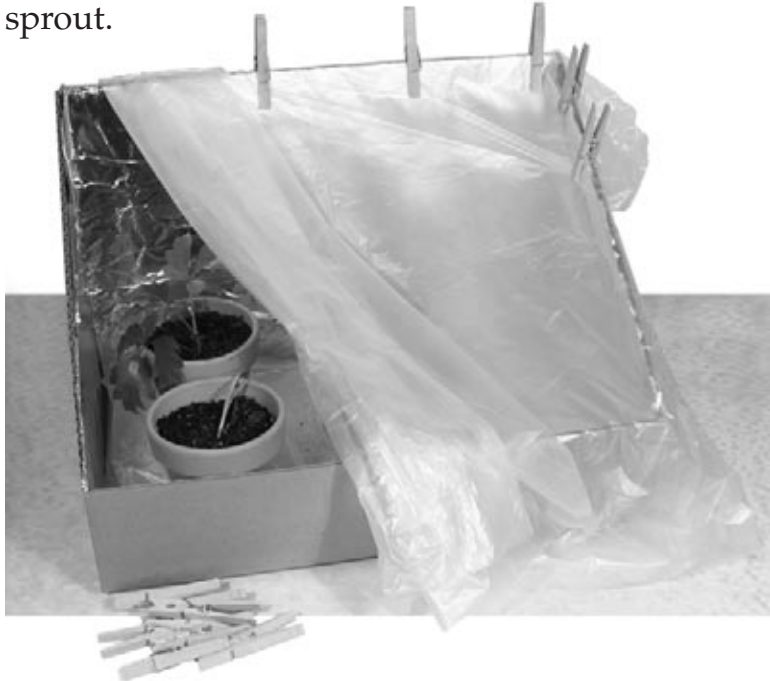
6 Pour small rocks or stones in a one-inch layer in the bottom of your plant pots. This will provide drainage for the roots of your plants. Pour a layer of potting soil on top of the stones or rocks to fill the pot within one inch of the top.



7 Plant your seeds in the plant pots according to the directions on the package. If you plant different types of seeds, be sure that each requires the same amount of sunlight and water. It will be difficult to maintain different growing conditions inside your greenhouse box.



8 Use the clothespins to attach the second sheet of plastic to the top of your box. Now you have a greenhouse. Place your greenhouse in a sunny location inside your house and watch your seeds sprout.



Tips for Greenhouse Care



Check on your greenhouse about once a week. Be sure the soil inside your greenhouse stays moist, but not wet. After the initial watering of your

seeds, use a spray bottle of distilled water (water that has been left out overnight in a container with no lid) to keep your plants watered. You may notice some water form on the inside of the plastic cover. This is normal, but make sure the soil is not too wet. If the soil does become too wet, pull back the plastic sheet so the greenhouse can dry out some before re-covering the box.

After your seeds have germinated, weed out the weakest plants. Leave only the strongest plants in the small space of the greenhouse. You can make the strong plants stronger by feeding them plant food or compost after weeding out the weaker plants. Do this only if the plants will later be moving to a garden outside. Plant food and compost will likely make the plants outgrow your indoor greenhouse too quickly if you want them to remain indoors during their whole growing cycle.



Conclusion

You now have a place in which you can enjoy gardening year-round like other gardeners around the globe. You can try growing plants, fruits, vegetables, seedlings, and flowers in your protected cardboard greenhouse, even when there is snow outside. Maybe you'll be able to keep cucumbers growing in the heart of winter.

Keep the Outside Dry!

Check the cardboard box every so often to make sure the outside remains dry. If you notice any water on the outside (including the bottom), you might have to replant your greenhouse in another box.



Glossary

botany (<i>n.</i>)	the study of plants (p. 6)
classify (<i>v.</i>)	to assign things or people to categories (p. 7)
climate (<i>n.</i>)	the weather conditions in an area over a long period of time (p. 6)
conditions (<i>n.</i>)	a set of circumstances necessary for something else to happen (p. 4)
germinate (<i>v.</i>)	to begin to grow from a seed (p. 5)
greenhouse (<i>n.</i>)	a structure often made from glass or plastic that is used to grow plants that need heat, light, and protection from harsh weather (p. 5)
hobbies (<i>n.</i>)	activities done for fun and relaxation (p. 4)
humidity (<i>n.</i>)	the amount of moisture in the air (p. 5)
photosynthesis (<i>n.</i>)	the process by which chlorophyll in plant cells transforms sunlight and nutrients into food (p. 9)
wavelengths (<i>n.</i>)	the distances between consecutive peaks or troughs of a wave (p. 9)

Name _____

Instructions: In the first row, write what you already know about greenhouses. In the second row, write what you would like to learn about them. After you finish reading, fill in the third row with information you learned from reading the book and the fourth row with what you still want to know.

K: What I Know
W: What I Want to Know
L: What I Learned
S: What I Still Want to Know

Name _____

Instructions: As you read, list causes in the left-hand column and their effect in the right-hand column.

Cause	Effect

Name _____

Instructions: The sentences below are taken from *How to Build a Greenhouse*. Read each sentence and add parentheses in the correct locations. Then, on the line below the sentence, write whether the parentheses were added to clarify or to add more information.

1. So how can a simple structure of glass or plastic do that?

2. This could be along the side of your house or within a group of deciduous trees which will protect it from cold winter wind and intense sunlight on summer afternoons.

3. Use the utility knife with the help of an adult to cut the box along the lines you have drawn.

4. After the initial watering for your seeds, use a spray bottle of distilled water water that has been left out overnight in a container with no lid to keep your plants watered.

5. If you notice any water on the outside including the bottom, you might have to replant your greenhouse in another box.



Tropical green house, located in Atocha train station, Madrid, Spain

Thomas Edison

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Word Count: 1,457



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Thomas Edison



Written by Joanne C. Wachter

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Thomas Edison



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Title page: Very early version of a telephone

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Table of Contents

A Curious Boy	4
Young Al.....	5
Edison the Inventor	8
A New Lab	8
Important Inventions	10
A Special Project	12
Other Exciting Ideas.....	14
A Remarkable Man.....	15
Glossary	16
Index	16



Edison once said, "I never pick up an item without thinking of how I might improve on it."

A Curious Boy

"Why?"

That was Thomas Edison's favorite question from the time he learned to talk. He spent his whole life exploring why and how things work. Once he knew how something worked, he tried to figure out how to make it work better. Thomas Edison invented or improved over a thousand things, some of which we use every day.

Young Al

Thomas Alva Edison was born on February 11, 1847. He was the youngest of seven children. Al, as he was called as a boy, lived in Ohio with his family until 1854, when they moved to Michigan.

Although he was smart and curious, Al did not do well in school. In those days, students memorized facts, and this bored Al, who wanted to ask questions and explore. After several months, Mrs. Edison took her son out of school and taught him at home. Al's mother taught him to love reading, and his father encouraged his

reading by giving him ten cents for every classic book he read.

At ten years old, one of Al's favorite books was a collection of science experiments. He took the book to the basement, set up a simple lab, and did every one of the experiments. He also built working models, including a steam-powered

sawmill, a railroad engine, and a simple telegraph machine.

Do You Know?

As a child, Edison developed a hearing problem. By the time he was an adult, people had to shout in his ear to be heard by him. Edison did not consider his deafness a problem, though. He said it helped him work without **distraction** and allowed him to sleep better.

Not only did young Al develop the skills of an inventor, but he also learned to be a businessman. He grew vegetables on his parents' land and sold them. Al's parents allowed him to take a job with the railroad when he was just twelve years old. He sold food and newspapers to the passengers. Al used the money he earned to buy books and science supplies. The young boy's hard work impressed his boss, who liked him so well that he allowed Al to set up a science lab in a baggage car.

When he was fifteen, Al got another idea for making money on the trains. He bought an old printing press, a machine used to print books

and newspapers, and published his own paper. He included stories about world events along with jokes, train schedules, and other articles to interest train riders. People bought the paper for eight cents a month.



Young Thomas Edison

That same year, Al's quick thinking saved a young boy's life. Al saw the boy wander onto the tracks as a train steamed toward him. Al raced to the tracks, scooped up the child, and carried him to safety. The child's grateful father, who was a telegraph operator, offered to teach Al his job.

Edison the Inventor

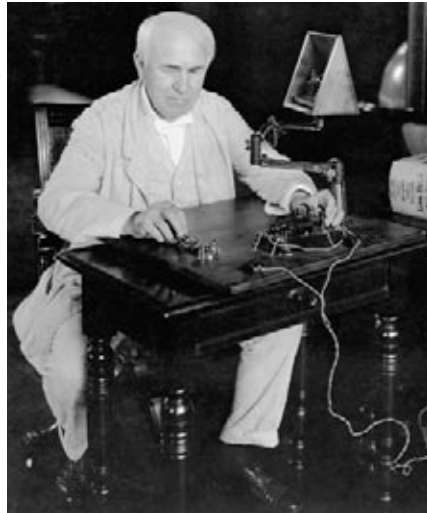
After a few years, Thomas Edison decided that what he really wanted to do was become a full-time inventor. Some of his early inventions were improvements on the telegraph machine. For example, he found a way to send four messages at once instead of just one.

The first **patent** that Edison received was for an electric vote counter. Edison thought that state lawmakers wasted a lot of time counting votes by hand. He made a machine that allowed lawmakers to press a button to tell whether they were for or against a bill. The results of the vote showed on a large board. The lawmakers were not enthusiastic, though. One said, "Young man, that is just what we do not want."

Such a critical response would have upset most people, but not Edison. He once said, "I never allow myself to become discouraged under any circumstances."

A New Lab

As ideas continued to flood his brain, Edison needed a new place to work and people to help him. He built a lab for his science experiments in Menlo Park, New Jersey, in 1876 and called it his "invention factory." This barnlike wooden



Do You Know?

The telegraph was a way to communicate before the invention of telephones. It used a code of dots and dashes to form letters to make a message sent over wires. The code was called Morse code. Here are the words "Morse code" in Morse code.

M	O	R	S	E	C	O	D	E
— —	— — —	— —	— — —	—	— — —	— — —	— —	—
		·	·	·	·	·	·	·

As Edison grew older, he traveled around the country as a telegraph operator. He now preferred to be called Tom. He continued to be interested in science, and spent much of the money he earned on books and supplies. He liked to work the night shift and use his days for experiments.



Edison in his lab, which he called his "invention factory"

building was the first **for-profit** research lab in the world. There, Edison worked twenty hours a day, only stopping to take short naps on a cot.

Thomas Edison believed that teamwork was a key to success. Edison sketched his ideas in notebooks and gave the sketches to his twenty-five workers, who then made working models. Edison filled 3,500 notebooks with ideas for inventions. Not all of these ideas worked, but Edison said, "Negative results are just as valuable to me as positive results. I can never find the thing that does the job the best until I find the ones that don't do it."



Edison improved existing devices, including the telephone.

Important Inventions

The first big project Edison and his team did at Menlo Park was finding a way to improve Alexander Graham Bell's telephone. People had to shout into the first telephones to make themselves heard. In 1877, Edison found a way to make a caller's voice louder and clearer.

Do You Know?

In 1871, Edison married Mary Stilwell. The couple had three children, Marion, Thomas, Jr., and William. Mary died in 1884, and Edison married Mina Miller a few years later. There is a story that Edison used the telegraph operators' code to ask Mina to marry him. Their children were Madelaine, Charles, and Theodore.

From what Edison learned by working on the telephone, he got another idea. Could he find a way to record voices to listen to later? He sketched an idea and gave it to one of his workers, who then made a model. The words to the nursery rhyme “Mary had a little lamb,” were recited into the machine. Much to everyone’s amazement, the machine played back the words.

This invention, called the phonograph, was very simple compared to modern tape recorders and CDs, but it was quite exciting to people in the 1800s. As soon as people heard about this invention, Edison became famous.

The only problem was that no one was sure what to do with the invention. Edison tried experiments such as putting a tiny phonograph inside a doll to make it “talk,” but the toy soon broke. It was not until years later that Edison realized that his invention could be used to record and play music.



Thomas Edison with first phonograph

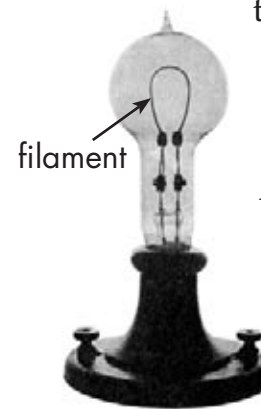
A Special Project

Edison wasted no time getting started with his next project. For fifty years, people had tried to find a practical way to use electricity to make light. Many inventors created light bulbs, but the bulbs either burned too brightly, too dimly, or burned out too fast. In 1878 Edison became determined to solve this problem and boasted that he would produce a practical light bulb in six weeks.



Edison with his experimental bulb

Edison said, “The three things that are most essential to achievement are common sense, hard work, and **stick-to-itiveness**.” The Edison team stuck to the task as they



The finished bulb

worked around the clock. The challenge was to find a material to use for the **filament**, the part of the light bulb that glows. Edison’s workers tried thousands of different materials until they found one that worked. The discovery took longer than six weeks, but Edison’s team had succeeded.

Edison opened the lab for visitors to see what his team had accomplished. People were amazed as they walked up a path lined with electric streetlights and entered the lab brightly lit with electric lights. Soon, everyone wanted electric lights.

In 1881 Edison moved to New York City to help start the first electric power plant. Before long, power plants in hundreds of communities were making it possible for people to switch from dangerous, smelly, dirty gas and oil lamps to electric lights.



Edison's lab was the first building to be lit by electricity.

Other Exciting Ideas

By 1886, Edison needed more space, so he moved into a larger lab and hired sixty workers. The team turned its attention to another exciting project. Edison found that if he recorded many still pictures and then showed them very fast, the images looked as if they were moving. This led to the invention of the movie projector, which

played many images quickly.

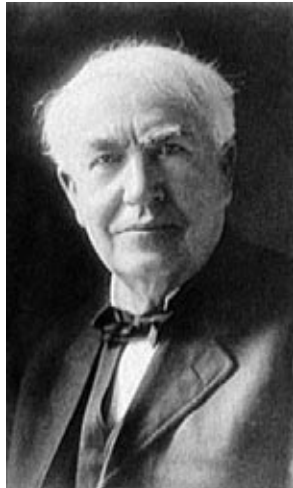
The first films Edison recorded were only thirty seconds long. He tried to link



Thomas Edison with film projector

the phonograph with this new invention but found it too hard to get the sound and pictures to match, so his films were silent.

Edison continued to pour ideas into his notebooks and work with his team to make his dreams come true. Some of his other inventions included machines for mining, improved batteries, and new uses for cement, such as building Yankee Stadium.



These are just a few of Edison's important inventions:

- 1868 Electric vote recorder
- 1869 Universal stock ticker
(kept track of stock market)
- 1872 Improved telegraph to send more messages
- 1877 Improved the telephone to be easily heard
Phonograph
- 1879 Electric light bulb
- 1891 Motion picture camera
- 1896 Fluorescent electric light
- 1900 Alkaline battery
- 1914 Electric miner's head lamp

A Remarkable Man

Throughout his life, Edison obtained 1,093 patents, which is more than anyone else, even to this day. He continued to work until he was more than eighty years old.

Thomas Edison died on October 18, 1931. President Herbert Hoover asked everyone in the country to turn out his or her lights for a short time to honor Edison. Sitting in the dark for a few moments, people could think about the great changes Thomas Edison had made in their lives.

As Edison once said, "If we did all the things we are capable of doing, we would astound ourselves." Thomas Edison's accomplishments still astound us today.

Glossary

- patent** (*n.*) a document granting the right the get profit from an invention (p. 8)
- for-profit** (*adj.*) set up to make money (p. 9)
- distraction** (*n.*) something that takes a person's mind away from the task at hand (p. 5)
- filament** (*n.*) threadlike part of a light bulb that glows (p. 12)
- stick-to-itiveness** (*n.*) continuing to work on a problem until a solution is found (p. 12)

Index

- batteries, 14
- Bell, Alexander
- Graham, 10
- electric light, 12, 13
- electric vote counter, 8,
- filament, 12
- Menlo Park, 8
- movie projector, 14
- phonograph, 11
- Stilwell, Mary, 10
- telegraph, 5, 7, 8,
- telephone, 7, 10, 11

Name _____

Instructions: Locate each word below in the dictionary and write its definition under the heading *Definition*. Then use each word in a sentence and write it under the heading *Sentence*.

Sentence			
Definition			
Word	develop	determined	remarkable

Name _____

Instructions: List the important events that you underlined on page 15 (including the box) in *Thomas Edison*. Then use the information to create a summary of the final section in the *Summary* box.

Who

What

When

Where

Why

Summary

Name _____

Instructions: On the lines below, create six sentences of your own containing a possessive noun. Circle the possessive noun in each sentence and underline the word that each possessive noun owns.

1. _____

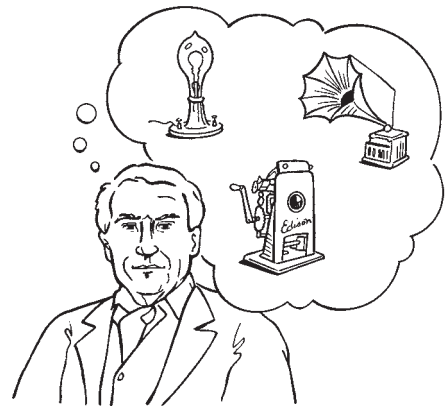
2. _____

3. _____

4. _____

5. _____

6. _____



Coral Reefs

A Reading A-Z Level U Leveled Reader

Word Count: 1,690

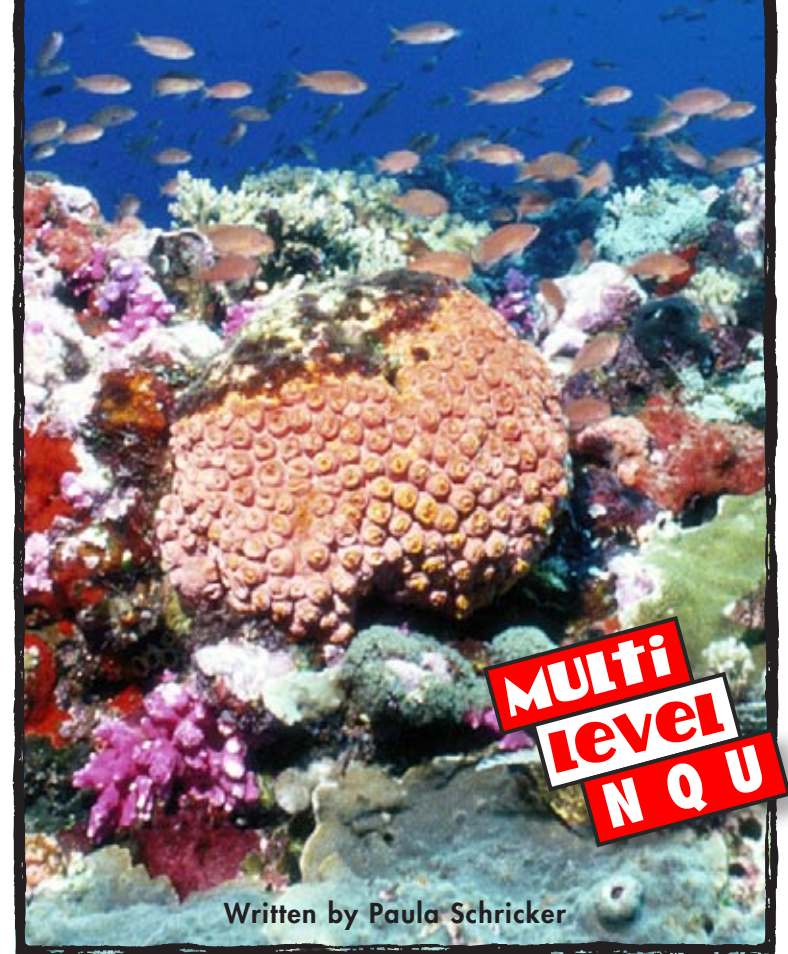


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Fountas & Pinnell	Q
Reading Recovery	40
DRA	40



Table of Contents

Introduction	4
What Is Coral?	5
A Busy Underwater Community.....	9
Where Do Corals Live?.....	11
Threats to Coral Reefs.....	16
Protecting the Reefs.....	20
Glossary.....	23
Index	24



Many kinds of coral, fish, and sea creatures live in a reef.

Introduction

Coral reefs are massive undersea communities that are home to thousands of living organisms. A reef can be hundreds of miles long. The “buildings” of this community are made up of many types and shapes of corals. Day and night, thousands of animal inhabitants bustle about, hunting, eating, and avoiding being eaten. Almost one-quarter of all the plants and animals in the ocean live around coral reefs. That’s over 4,000 kinds of fish and 700 kinds of coral that make reefs their home.

What Is Coral?

The many corals that form the reefs may appear at first glance to be oddly shaped rocks or spiny plants. Corals are actually groups of tiny animals called **polyps** (PAH-lips). Most polyps are very small—between the size of a pinhead and the size of a pea. One branch or mound of coral can have thousands of these tiny, pea-sized polyps attached to it. Each polyp has a sac-like body and a mouth that is surrounded by tiny tentacles. Polyps are eating machines. At night, they extend their tentacles, like arms and hands, to catch tiny animals and nutrients they need.



Polyps open their tentacles only at night.



These feathery polyps form branches.

There are hundreds of kinds of corals. Most of them are divided into two main types: hard, or “stony,” corals and soft corals. Stony coral polyps form hard skeletons. When the outer polyps die, their hard skeletons remain. Over time, the accumulation of millions of these hard skeletons helps to build a reef. Most kinds of stony corals live together with various species of plants called algae (AL-gee). The many types of algae help to supply food for the coral and for many of the fish that live around the reef.

Soft corals grow flexible, woody cores instead of the hard skeletons that stony corals have. Soft corals are able to bend with the tides. Some kinds of soft coral are poisonous and will sting if touched. Others, like the sea pen coral, will collapse and hide in the sand if they are approached.



(Left) A sea fan (a soft coral); (right) a brain coral (a stony coral)

Corals are often named after what they resemble. Stony corals include brain corals, which look like brains, and elkhorn corals, which look like the broad horns of an elk. Soft corals often look like trees or other plants. Soft sea whips and sea pens have long, narrow branches covered with polyps. Sea whip polyps are about one quarter-inch long with eight tentacles each. The tentacles catch tiny animals and fish. Sea fan corals are wide and branching—like a fan. Their expansive shape traps bits of **plankton** to eat as they drift by.



Elkhorn coral branches out as an elk's horns do.



Schools of brightly colored fish are common on reefs.

A Busy Underwater Community

Most people think of brightly colored fish when they think about coral reefs—and with good reason. Thousands of fish, from large sharks to the tiny goby, inhabit reefs. They depend on the reef for food and for protection from becoming food themselves. Some fish live off the algae and plankton around the reef, and some eat other fish that live there. A few types of fish even eat the coral itself.



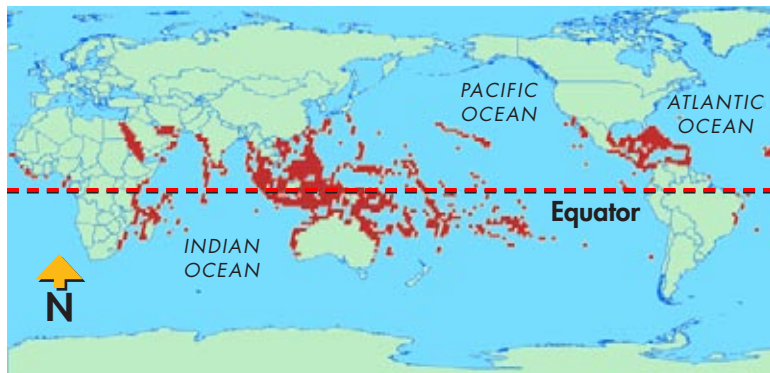
Reefs offer many good hiding places for animals such as this moray eel.

Crustaceans such as shrimp, lobsters, and crabs also prefer reefs as a favorite eating spot. Sea urchins and starfish catch clams and smaller shellfish hidden among the coral branches. Waving sea anemones, which look like graceful flowers, hide in shallow **crevices** of the reef to wait for their food to drift past. Large holes in the reef make good homes and hiding spots for moray eels. No space is wasted on a bustling reef.

Where Do Corals Live?

Most reefs are located close to shore in warm tropical waters. They can also grow where warm currents flow from the tropics, such as in Florida and southern Japan. Coral grows best in warm water that is between 21 and 29 degrees Celsius (70–85° F).

Since algae need sunlight to make food, most corals must live near the surface of the water. A few colonies of deep, or cold-water, coral have been found at depths from 900 to 1,800 meters (3,000 to 6,000 ft.). These individual coral patches don't form long reefs but they do provide shelter for many different types of fish. Since algae cannot grow at depths where light is limited, the deepwater corals feed on other organisms.



The dark areas of the map show the location of coral reefs.



Sediment and pollution from the Mississippi River enters the Gulf of Mexico.

Besides needing the right depth and temperature to thrive, coral reefs are sensitive and cannot survive in many areas because of environmental conditions. They do not grow well near the mouths of rivers, where dirt, debris, and freshwater **runoff** flow into the sea. Fresh water can kill coral. Dirt and debris can cause serious physical damage to reefs. Dirt and excess salt can also interfere with corals' food source. Reefs can be smothered by dirt or invading plant life. Large, violent waves, such as those caused by a **tsunami** (sue-NAH-mee), can even break reefs. If a powerful tsunami strikes an area, thousands of years of coral growth can be destroyed in just a few hours by the force of the wave surges.

As corals are very slow growing, a reef takes a long time to expand its size or to recover from damage. Stony corals, such as brain corals, grow the slowest. They add only 5 to 25 millimeters (0.2–1 in.) of skeleton per year. Most reefs are between 5,000 and 10,000 years old. Some living coral reefs began growing almost 50 million years ago.

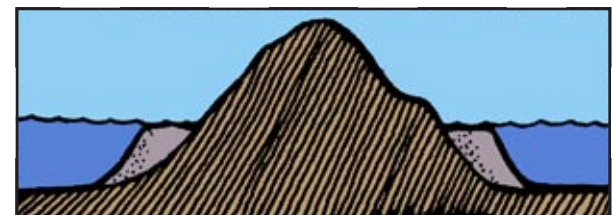


Large brain corals can be thousands of years old.

There are three types of coral reefs: **fringing reefs**, **barrier reefs**, and **atolls**. Fringing reefs are located close to the shore. They usually follow the natural shoreline, or fringe, of the land. Fringing reefs are common in Hawaii and parts of the Caribbean.

Barrier reefs have a larger **lagoon**, or area of water, between the reef and the shore. The largest barrier reef in the world is the Great Barrier Reef in Australia. It is 2,000 kilometers (over 1,242 mi.) long. It is made up of over 3,000 individual reefs and islands and is home to nearly 2,000 types of fish. The Great Barrier Reef is the only living structure large enough to be seen by an astronaut standing on the moon. Its oldest sections are millions of years old. Most of the modern Great Barrier Reef ranges in age from 6,000 to 500,000 years old.

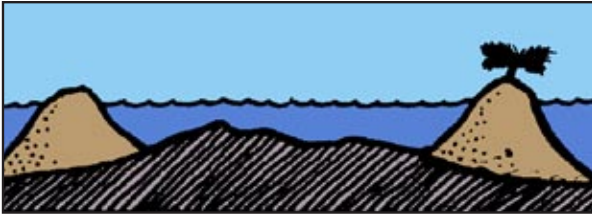
Cross section of a fringing reef



Cross section of a barrier reef



Cross section
of an atoll



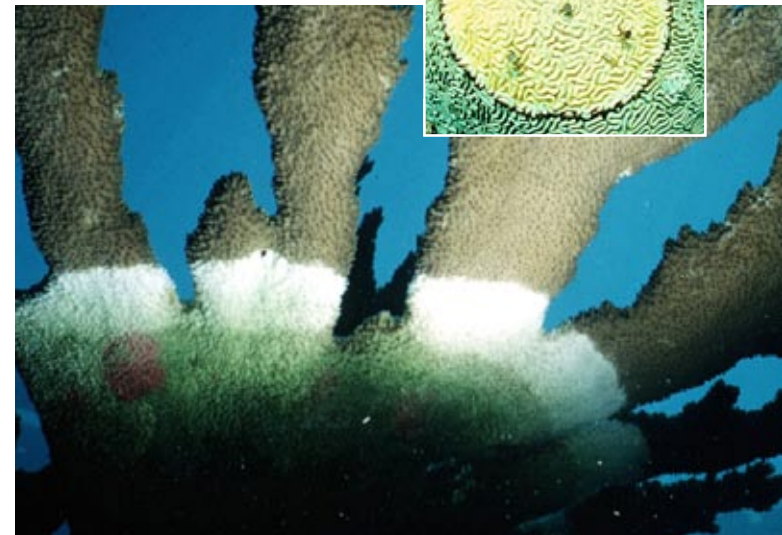
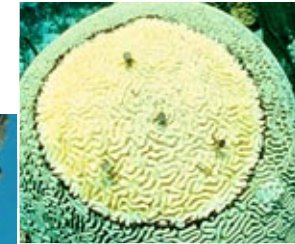
Aerial view of an atoll

An atoll is a type of reef that forms in a circular pattern around a sinking island or an aging island volcano. As the island ages and sinks, or as the volcano continues to erupt and break apart, the remaining land eventually disappears beneath the ocean's surface. When that happens, the growing reef forms a circle around a central lagoon. The largest atoll, in the western Pacific, has a lagoon that measures over 97 kilometers (60 mi.) across.

Threats to Coral Reefs

Coral reefs are very fragile, and many things can damage them. The two things that cause the most damage are disease and humans. Some conditions, such as white band and black band diseases, are caused by a combination of destructive bacteria. In most cases, the band of bacteria advances up the branch of the coral, destroying the coral polyps and leaving the skeleton behind. The skeleton can then be attacked or colonized by other damaging organisms. These fast-growing diseases can wipe out an ancient coral reef in weeks.

A dark ring resulting from
black band disease



White band disease can destroy coral quickly.

Another condition, known as **bleaching**, occurs when something—usually bacteria—attacks algae, the coral's main source of nutrients. Normally, algae live in the tissues of the coral and provide a constant source of food. Their presence even colors the coral polyps. If the coral senses that the algae have become infected, it expels them. By losing the algae, the coral polyps lose their main source of food as well as their color. They begin to starve, and without their coloration they become transparent, making their skeletons visible. The white skeleton makes them look "bleached."



The white area of this coral has been bleached.



These bleached corals would normally be more brightly colored.

Most reef scientists believe that a rise in the temperature of the water makes the bacteria grow—and grow faster. If the water temperature returns to normal again, the invading bacteria die off and the algae can recover. Sometimes, coral can recover from bleaching. But if the situation that caused the bleaching does not change, the coral, and the reef, will die.

Humans are responsible for most of the destruction of coral reefs. Fishing methods that use poisons and explosives have destroyed over half the reefs in the Philippines. Seaside resorts and homes create soil **erosion** and polluted freshwater runoff. Fresh water is damaging to coral, and the runoff may also contain chemicals as well as waste material.

People damage reefs more directly, too. Sport boats and commercial ships break off large chunks of reefs. Gas and oil from boat engines seep into the reef **habitat**, poisoning coral, plant, and fish life. Some sport divers drop their boat anchors directly onto reefs or stand on the fragile coral. Others break off pieces of live coral to take home as souvenirs or to sell.



Boats sometimes break off large chunks of coral.



Each year, volunteer divers help clean some reefs of debris.



This officer's job is to watch and protect coral reefs.

Protecting the Reefs

In addition to being naturally beautiful and appealing as recreational destinations, coral reefs are a valuable natural resource. Reefs help shelter our coasts from storms and floods. They are a critical habitat for much of the world's seafood and, as such, contribute to the economies of many countries. Reef plants and animals also provide many important ingredients for medicines.

Many countries have taken steps to preserve their reefs. In Florida and on the Great Barrier Reef in Australia, it is illegal to take fish, plants, or coral from protected areas. Humans and boats are not allowed near many fragile reefs. But this is only a start. Only about 3 percent of the world's coral reefs are protected, and many of the laws and guidelines are not consistently enforced.



Divers still enjoy visiting fragile reefs.

Almost a quarter of the world's reefs have already been destroyed. Nearly 60 percent are threatened. It is up to all of us to help prevent reef destruction. Even if you don't live near an ocean, your actions can have an effect on the health of coral reefs. Be careful not to litter or drop anything in the water. Learn what human actions cause an increase in ocean temperatures and the growth of bacteria. Conserve water and energy, and recycle as much as you can. If everyone does his or her part, coral reefs will remain a beautiful, natural wonder for centuries to come.



These human-made objects are put in the ocean to provide a safe place for new coral to attach and grow.

Glossary

atoll (<i>n.</i>)	a circular reef formed when coral grows around an island, and that island sinks beneath the surface of the sea (p. 14)
barrier reef (<i>n.</i>)	a reef that sits farther from the shoreline, forming a barrier between the open ocean and the calm lagoon (p. 14)
bleaching (<i>n.</i>)	when coral turns white after its algae die (p. 17)
crevices (<i>n.</i>)	cracks and holes (p. 10)
crustaceans (<i>n.</i>)	hard-shelled, many-legged sea creatures such as lobsters, shrimp, and crabs (p. 10)
erosion (<i>n.</i>)	wearing or washing away of the soil (p. 19)
fringing reef (<i>n.</i>)	a reef very close to a shoreline (p. 14)
habitat (<i>n.</i>)	the place where a plant or an animal lives in nature (p. 19)
lagoon (<i>n.</i>)	shallow, calm water between a reef and the shoreline or in the center of an atoll (p. 14)
plankton (<i>n.</i>)	tiny animal or plant life in the ocean (p. 8)
polyps (<i>n.</i>)	tiny individual coral animals (p. 5)
runoff (<i>n.</i>)	soil, debris, and pollution that flows from streams and rivers into the sea (p. 12)
tsunami (<i>n.</i>)	a great wave caused by an earthquake, volcano, or landslide (p. 12)

Index

algae, 6	Great Barrier Reef, 14
atoll, 14	habitat, 19
black band disease, 16	hard corals, 6
bleaching, 17	plankton, 8
barrier reefs, 14	polyps, 5
brain corals, 8	sea pen corals, 7
cold-water corals, 11	sea whips, 8
coral growth, 12	soft corals, 6
elkhorn corals, 8	stony corals, 6
fringing reefs, 14	white band disease, 16



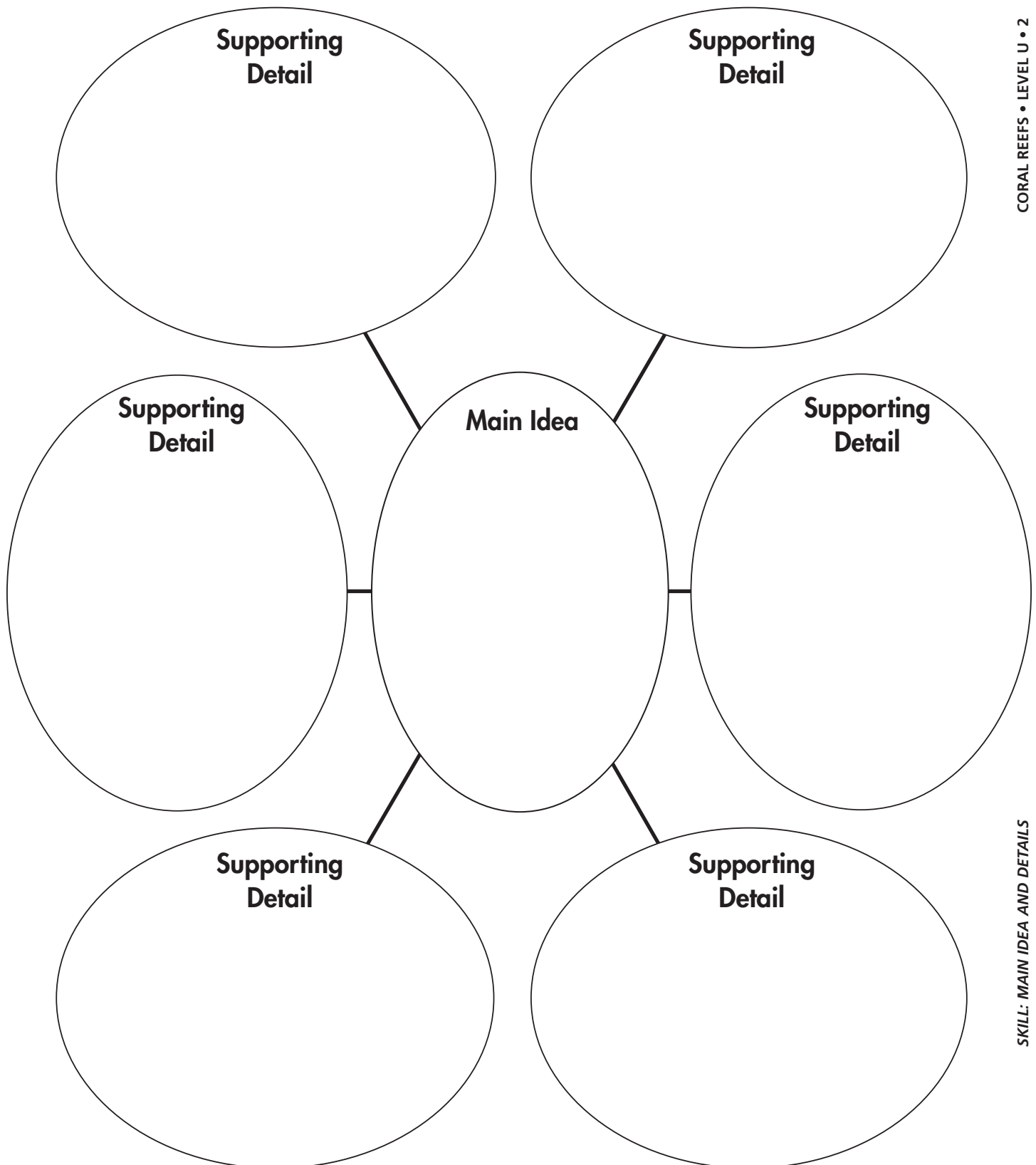
Name _____

INSTRUCTIONS: In the first column, write what you already know about coral reefs. In the second column, write what you would like to learn about them. After you finish reading, fill in the third column with information you learned from reading the book and the fourth column with what you still want to know.

What I Know	What I Want to Know	What I Learned

Name _____

INSTRUCTIONS: Write the main idea for the section titled "Threats to Coral Reefs" in the center of the web.
Record the supporting details in the surrounding circles.



Name _____

INSTRUCTIONS: Circle the preposition in each sentence below. Then on the line, write whether the preposition tells *where*, *when*, *how*, *why*, or *with what*.

1. They live with plants called algae. _____
2. The algae is food for the coral. _____
3. Thousands of polyps can live on a piece of coral. _____
4. They can bend with the tides. _____
5. Shrimp, lobster, crab, and starfish eat on reefs. _____
6. Fresh water that comes from rivers can kill coral. _____
7. Barrier reefs have a large lagoon between the reef and shore. _____
8. It grows around an old sinking island. _____
9. After the island is gone, a water lagoon forms. _____
10. Reefs help protect coasts from storms and floods. _____
11. We can help even if we don't live near the ocean. _____
12. Never throw things in the water. _____

Name _____

INSTRUCTIONS: Below are words taken from *Coral Reefs*. Cut along the dotted lines to separate the boxes. Then move the boxes around on a flat surface to arrange the words in alphabetical order.

skeletons	crab	lagoon
freshwater	island	coral
reefs	medicines	water
seashore	algae	fish
colors	polyps	sea

Arrows

A Reading A-Z Level U Leveled Reader

Word Count: 2,375




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ARROWS



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Illustrated by David Cockcroft

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Photo Credits:

Page 7: courtesy of the William Hammond Mathers Museum, Indiana University

The photograph on page 7 shows the Choctaw Telephone Squad at Camp Merritt, New Jersey, on June 7, 1919.

From right to left : Captain E.H. Horner (Commanding)

Private James Davenport, Choctaw, age 27

Corporal James Edwards, Choctaw, age 20

Corporal Calvin Wilson, Choctaw, age 24

Private Mitchell Bobbs, Choctaw, age 25

Corporal Taylor Lewis, Choctaw, age 22

Arrows

Level U Leveled Reader

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Reading Recovery	40
DRA	40



TABLE OF CONTENTS

The First Arrow	4
Questions.....	8
Answers.....	12
Cracking the Code	16
The Drinking Gourd	20
Glossary	24

THE FIRST ARROW

Poloma was tossing her new ball high into the Mississippi air when she discovered the first arrow in the forest. On that summer morning, she was aiming for the Sun, throwing the ball higher and higher, so when it came down and rolled away she had only herself to blame. The ball bounced off a tree trunk, flew over a log, and came to rest at the base of a huge boulder.

She was digging the ball out from the heavy undergrowth when she noticed the arrow carved into the lower part of the massive rock.





Poloma grabbed her ball and raced home. Her grandfather was resting on the porch swing. His eyes were closed, and for a moment, she wondered whether she should wake him with the news.

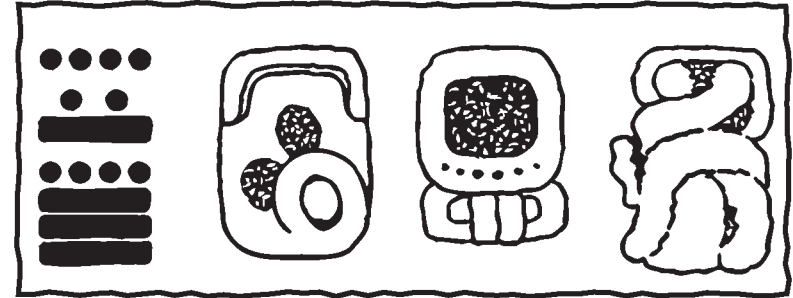
“You’ve discovered something,” he said softly, when she was settled beside him. “I can tell by the way you’re fidgeting.”

“I’ve found an arrow, Papa!” Poloma kicked her feet, and the swing moved back and forth, making a gentle, reassuring, squeaking sound.

“And where is this arrow that excites you so much?”

Poloma told her grandfather about the bouncing ball, the boulder, and the arrow that was carved near the bottom of it.

“Do you think the arrow is a **glyph** like the ones in my **code** books?” Poloma asked. “Maybe it’s a Mayan hieroglyphic. The Mayans used tiny pictures instead of words and letters. Maybe they carved that arrow,” Poloma guessed.



Papa pulled himself out of the swing and smiled down at his granddaughter. “That’s a very good question,” he said. “But I doubt that the Mayans were carving rocks around here. The Mayans lived farther south, in Mexico and Central America. However, your arrow might very well be part of a code of some kind, but we might have to do some research to find out.”

Poloma’s grandfather knew a lot about codes. In fact, he had won a medal for his code work during World War II. Papa and other Native American **Code Talkers** had helped the United States and its allies win the war by sending secret messages in languages that people from other nations could not understand.

“Will you tell me again, Papa?” Poloma pleaded. Poloma loved to hear the story of the Code Talkers, even though she had heard it many, many times before. She especially liked to hear about the **Mississippi Choctaw** Code Talkers like her grandfather.

“Come,” her grandfather said, as he took her hand and pulled her from the swing. “I think we should visit this mysterious arrow. I’ll tell you about the Code Talkers while we walk.”

As they made their way toward the boulder, Papa told Poloma the story of how he and other Code Talkers sent messages that only other Native American Code Talkers could **interpret**.



This group of Oklahoma Choctaw soldiers from World War I paved the way for other native languages to be used as codes in World War II.



QUESTIONS

“We spoke into walkie-talkie radios,” he explained. “There was a Code Talker on each end, and we would only use Choctaw words that no one else could understand. Someone would give me the message that I was to pass on, and I would speak the words in Choctaw. The Code Talker on the other end would receive my message and **translate** it into English for the soldiers. If the enemy was listening on the radio, they wouldn’t be able to understand what we were saying.”

Poloma and her grandfather were at the boulder now. They knelt down, and Poloma pointed to the roughly carved arrow. Wind and rain had eroded and smoothed the arrow's edges so much that Poloma might not have seen it had she not been paying attention.

"What do you think it means?" she asked.

Papa ran his finger back and forth over the carving. "I'm not sure," he said. "It's a very old carving, but it's hard to determine its age. It takes a lot of work to figure out how old a carving is."

"How do people know?" Poloma asked.

"Well, there are many ways. Remember the cave paintings we saw last summer, and the old fossils and bones we saw at the natural history museum? Scientists use a method called **carbon dating** to figure out how old those things are."

"Can we use it to tell how old our arrow is?" Poloma asked.

"Maybe someone could date the plants in the cracks nearest to the carving, but that might not necessarily tell us how old the carving itself is." Papa told her. "Let's try something else. Let's try studying the arrow as it is."

Poloma stared at the arrow for a long time. Suddenly, she had an idea.

"I know!" she shouted. "How about if we consider where the arrow is pointing?"

The arrow was pointing toward another boulder nearby. Poloma and Papa followed it and found the second arrow almost immediately. The second arrow was pointing in the same direction as the first, so they followed that one, too. It led to another boulder, and another arrow, which led to yet another, and then another arrow.

There were six arrows in all.





"What do you think it means, Papa?" Poloma asked as she ran her finger over the sixth arrow.

"I think it means we should look for the next arrow," Papa laughed. "The arrows are sending us somewhere, and I'm very curious to find out where."

They continued on in the direction the arrows had been leading them but saw no more boulders. The arrows led them straight toward a stream.

"What should we do?" Poloma asked.

"I guess we should cross the stream. It looks very shallow, so if we tiptoe from stone to stone, perhaps we'll find another arrow on the other side. Hold my hand tight; we'll cross together."



ANSWERS

They crossed the stream, holding hands, stepping carefully. When they reached the other side, they almost crashed into the next boulder. It was hidden in a grove of old pine trees.

"Do you think there's anything carved on it?" Poloma asked.

"Let's take a look," Papa said.

They knelt down together, side by side, and examined the boulder. At first they couldn't find an arrow or any other carving, and they were about to give up when Poloma screeched.

"I found something! I found something!" she shouted as she leaned closer to the boulder and scraped off some moss with her fingers. "Look, Papa! It's not an arrow at all—a whole bunch of letters are carved into the lower part of the boulder! I wonder if we can make them out," she said.

"I'm afraid you'll have to read them to me," Papa stood up slowly, rubbing his knees. "My eyes are too old to make out tiny letters that have been hidden behind overgrown weeds for such a long time. I'm afraid my knees aren't too good either."

Poloma leaned closer to the boulder and studied the letters. It took her a long time, but she was finally able to read them all.

"They don't make any sense," she said. "I'll say them to you, but I don't think they mean anything at all."

Poloma read each letter out loud, very slowly.

g p m m p x u i f e s j o l j o h h p v s e

When she was finished, she said, "Maybe they're a code. Do you think they could be a code, Papa?"



"Read them again," Papa said. "Maybe I can make some sense of them if you read them again."

Poloma said the letters again, and then she repeated them one more time. As she read, she could hear her grandfather's footsteps. He was pacing slowly through the dead leaves and pine needles. Papa always paced when he had something important to think over.

"Do they mean anything to you?" she asked when she was done.

"Indeed they do," her grandfather said, still pacing. "Indeed they do."

"What do you think the letters mean?"

"I'm not exactly sure," Papa told her. "But I think it's a cipher, and I think I recognize it."

Poloma knew what a cipher was. It was a code that substituted letters or numbers for the real letters in a message.

"Ciphers like that one have been used in many wars to keep the enemy from learning about battle plans," Papa explained.



CRACKING THE CODE

"Did you use a cipher in the war?" Poloma asked.

"I saw them used in World War II. The Germans had a very clever machine called the Enigma Machine that substituted letters for other letters. The Code Talkers often used a cipher as well in case a Native American language speaker was captured and forced to translate messages by the enemy. But the first substitution cipher was invented by Julius Caesar more than 2,000 years ago."

This is an example of a Caesar Cipher. Can you break the code?

nbc m cm uh yrugjfy iz u wuymul wcjbyl

Hint: This cipher shifts each letter in the alphabet forward by the same number of letters.

"I wonder if these letters were used in a war, too," Poloma said.

Papa had to think about that. He paced for a very long time, and then he stopped beside his granddaughter and cleared his throat.

"I think I remember something," he said. "As you know, a great war took place right around here."

"The Civil War—right, Papa?" Poloma asked.

"Yes. About 150 years ago, the Civil War was fought to free the slaves in the South. I think I remember reading that the soldiers and spies in the North used a special cipher."



"Do you remember what it was, Papa?"

"It was sort of like the Caesar Cipher. Read me the letters again."

Poloma read the letters slowly.

g p m m p x u i f e s j o l j o h h p v s e

"You forgot the spaces," he said. "Read the letters again, and don't forget the spaces between the words."

Poloma read the letters again. This time she was careful to pause wherever she saw a space.

g p m m p x u i f e s j o l j o h h p v s e

She was just about to ask her grandfather what the letters meant when she noticed something in the cipher that she had seen in codes she had **deciphered** before. Most sentences contain at least one short common word, and this one was no different.

"I think I see some interesting letters," she said. "Let's say the letters form words. One of the words has three letters. Let's guess that it's a common word . . ."

". . . like *and*?"

"Or *the*," Poloma suggested. "There has to be one common word in a sentence."

Poloma and Papa were quiet for several minutes as they thought about the three letters.

"I don't think it's *and*," Papa said. "The letters don't make sense."

"But it could be *the*," Poloma said. "Maybe the letters *uif* stand for *the* in some way."

Papa was smiling now. "You are a very smart

girl," he said. "What letter comes before *u* in the alphabet?"

"*T*," Poloma said. "And the letter *h* comes before *i*, and the letter *e* comes before *f*. This is a substitute-letter cipher, Papa!"

"Yes! I remember now! During the Civil War, some Northern spies and soldiers used a code called the advance cipher. They advanced each letter one letter of the alphabet."



THE DRINKING GOURD

Once they had cracked the code, it was easy to read the message.

"Do you know what it says?" Poloma asked.

"I *do* know what it says. Do *you* know what it says?"

"I know what it says, Papa. It says, 'Follow the Drinking Gourd.' But I don't know what the message means. Do you know what it means?"

Papa chuckled and sat down on a hollow log. "We've made quite a discovery," he said. "We have found six arrows pointing in the same direction. If people followed the arrows, they would reach this boulder, and they would find this cipher. I wonder if the arrows and the cipher were carved during the Civil War."

Papa was pacing again now, and Poloma could tell that he was thinking things over in his mind.

"Before the end of the war," he said, "many slaves wanted to escape to freedom in the North. They followed what was called the Underground Railroad. It wasn't really a railroad. It was just a series of routes and directions and safe houses that led the slaves northward. Some slaves who had escaped returned to help other slaves."

"But who carved the arrows, Papa?"

"I'm not sure if we'll ever know that," Papa said. "It might have been a Northern spy trying to help. It might have been a returning slave who had learned the cipher in the North. Or maybe it had nothing to do with the war. Who knows? Maybe some children were playing a game."

"Did escaping slaves ever carve directions in trees or rocks?" Poloma asked.

"I've never heard of it happening, but every day people find new information about the Underground Railroad. Just recently, someone discovered a hidden tunnel and a secret room in a house in Iowa where slaves hid out on the way north."

A Code in Song

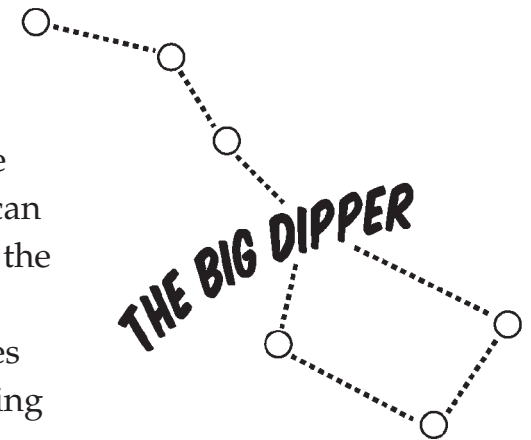
Here's the first verse of a folksong that gives directions north on the Underground Railroad.

*When the sun comes back and the first quail calls,
Follow the Drinking Gourd.*

*For the old man is waiting for to carry you to freedom,
If you follow the Drinking Gourd.*

"What does 'Follow the Drinking Gourd' mean?" Poloma asked.

"The Drinking Gourd is the group of seven stars now called the Big Dipper, which can always be found in the northern sky of the United States. Slaves followed the Drinking Gourd from safe house to safe house, until finally they reached freedom."



The sun was beginning to set, and tiny slivers of light were flickering through the branches. Poloma took her flashlight from her backpack, turned it on, and took her grandfather's hand.

By the time they were on the other side of the stream, the sun had disappeared. Poloma stopped and studied the sky.

"Are you looking for the Drinking Gourd?" her grandfather asked.

"There it is!" Poloma was pointing to the bright shape in the sky. "Shall we follow it?"



"It's your decision. Are we heading north?"

Poloma had to think about that for a minute. The Drinking Gourd would lead them back across the stream, past the boulder with the cipher, and on and on to places north.

"We need to go south, Papa."

Poloma and Papa turned. They moved slowly, like creeping night creatures. The light from Poloma's flashlight led them away from the North Star, past the arrows pointing the other way, out of the woods, and home.

GLOSSARY

carbon dating (<i>n.</i>)	a test to determine age that analyzes the content of carbon, an element in organic material (p. 9)
code (<i>n.</i>)	a system of letters, symbols, or signals that have special meaning and are used to send messages (p. 6)
Code Talkers (<i>n.</i>)	members of Native American tribes who used their native languages as codes during World Wars I and II (p. 6)
deciphered (<i>v.</i>)	worked out the meaning of a secret message or writing (p. 18)
glyph (<i>n.</i>)	a picture or other character with special meaning that is often carved into something (p. 6)
interpret (<i>v.</i>)	to tell the meaning of (p. 7)
Mississippi Choctaw (<i>n.</i>)	a Native American tribe, rich in history, that traditionally has lived in present-day Mississippi, Louisiana, and Alabama (p. 7)
translate (<i>v.</i>)	to take something written or spoken in one language and change it to another language (p. 8)

Name _____

INSTRUCTIONS: As you read Chapter 2 in *Arrows*, identify the important information by answering the questions in the chart. Record the information in the spaces below. Then use the information you've collected to write a short summary.

Who?	
What?	
When?	
Where?	
Why?	

ARROWS • LEVEL U • 1

← Summary →

SKILL: SUMMARIZE

Name _____

INSTRUCTIONS: Read the pronouns in the word box. Then read each sentence. Replace the underlined word or words in each sentence with a pronoun from the word box. Write the new sentence on the line.

him	her	they	it
she	he	it	we

ARROWS • LEVEL U • 2

1. Grandfather won a medal for his code work during the war.

2. The carving was very old.

3. Grandfather looked at Poloma and smiled.

4. Do you think there's anything carved on the rock?

5. Poloma and her grandfather were both interested in ciphers.

6. She asked her grandfather about the Civil War.

7. Grandpa and I solved the cipher together.

8. Poloma was proud of her discovery.

SKILL: PRONOUNS

Name _____

INSTRUCTIONS: Read each sentence below. Using a thesaurus, find two synonyms for the underlined word in each sentence. Write the synonyms in the box next to each sentence. Then choose one synonym to rewrite the sentence on the line provided.



1.

Poloma found an arrow carved in a big rock.

2.

Grandfather paced when he had an important matter to think about.

3.

Poloma asked good questions to learn more about codes.

4.

Grandfather told interesting stories about Code Talkers.

5.

Poloma and Grandfather were excited when they deciphered the code.

